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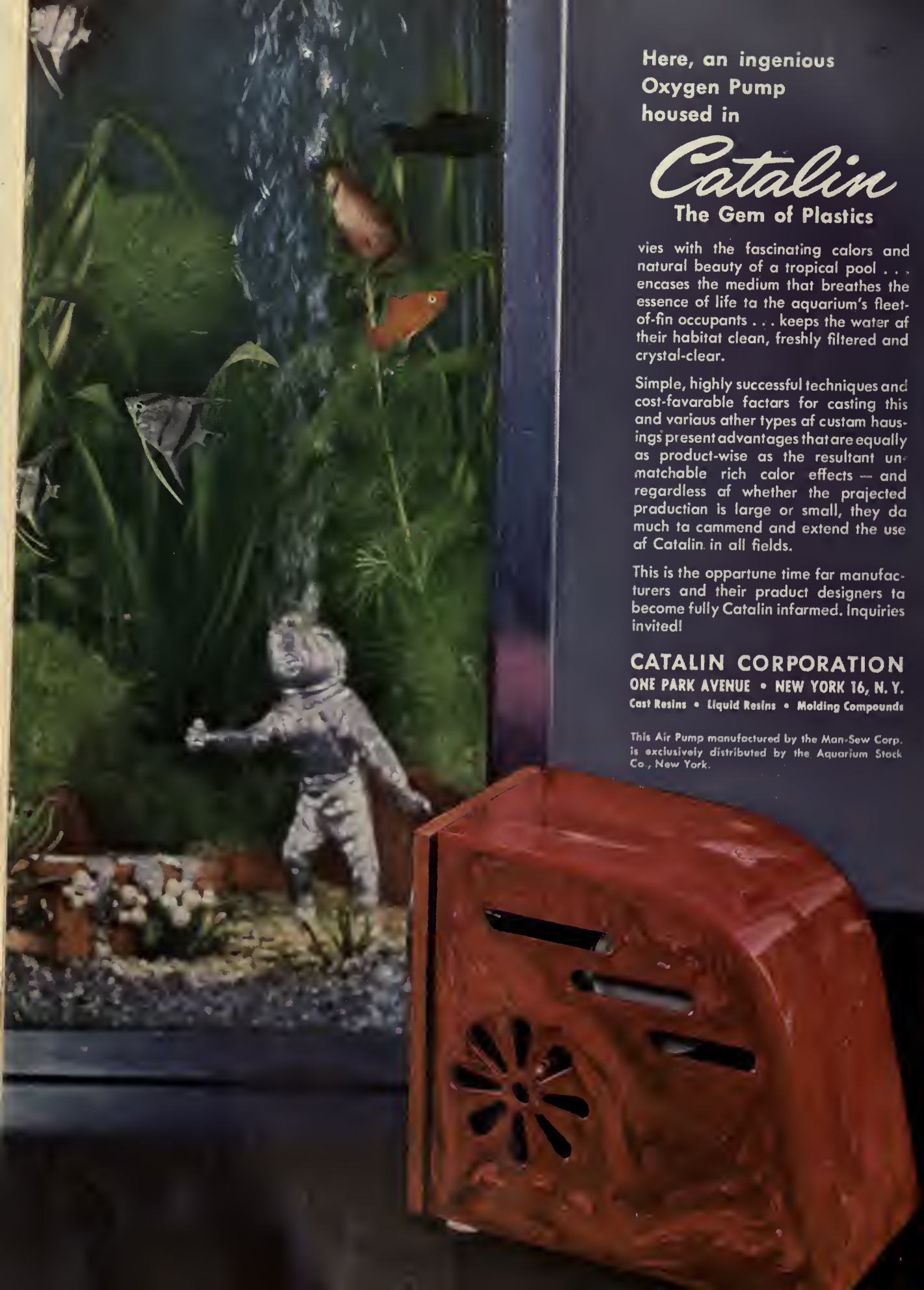

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This Air Pump manufactured by the Man-Sew Corp. is exclusively distributed by the Aquarium Stock Co., New York.

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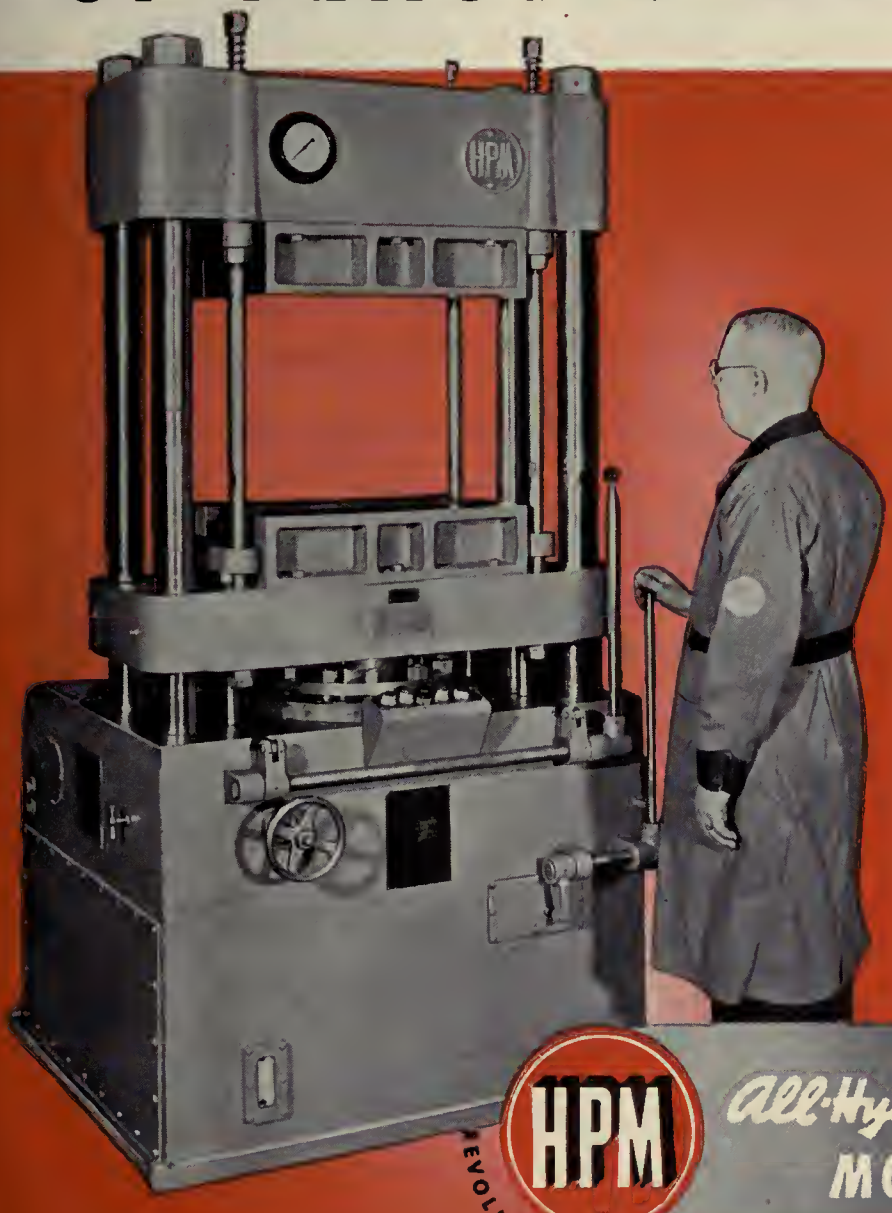
FOR Compression Molding OF PLASTIC MATERIALS



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HPM

All-Hydraulic COMPRESSION MOLDING PRESSES

A 100-ton H-P-M compressian malding with 24" x 18" platens.

REVOLUTIONIZING PRODUCTION WITH HYDRAULICS SINCE 1877

JANUARY, 1946

plastics

VOLUME 4, NUMBER 1

in this issue

Breathe Easier ..... *Jack D. Stratton* 29
Producing Better Printing Inks ..... *Philip Pollack* 34
And Now It's Luggage ..... *Barbara Baer* 40
Reconversion in the Molding Plant ..... *J. H. Du Bois* 42
Know the Cold Molded Plastics ..... *B. F. Hantz* 46
Plastics In Armor ..... *Margarita Dobert* 55
The Resorcinol Resins Prove Their Worth, Part 2 .... *R. L. Shipley* 58
What Paper for Laminates? ..... *Robert W. Barber* 66
Inserts—Their Design, Selection and Use 72
A Consumer Speaks Up! ..... *Wynn Stephanson* 90
There Will be More Materials in 1946 92
Program of SPE Annual Meeting 98
Heat-Sealing Thermoplastics 126

departments

Plastics in Perspective 26
Plastics at Work 64
On the Drafting Board 71
Capital Report 84
Association Activities 100
What's New in Plastics? 103
Literature Review 105
Problems in Plastics 108
Industry Highlights 109
People 111
Engineering News Letter 113
Plastics Overseas 116

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COVER

Acrylic mockup of Douglas C-54 hydraulic system, installed at Western Technical Training Command school at Douglas Aircraft Co., Santa Monica plant. Photograph by Lew Nichols.

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Shoe parts made from Geon . . . suggest many other interesting applications

New material adds permanent beauty —lengthens shoe life

THOSE strips of shoe trim material in the picture look ordinary enough—but actually they're revolutionary. For GEON polyvinyl materials have made possible completely new techniques in shoe styling and manufacture. The GEONS are thermoplastic raw materials that can be extruded (as these strips were), pressure or injection molded, cast or calendered into sheet or film, or used as coatings for fabric and paper.

As a shoe material GEON can be used for trim, soles, heels, welts and ribs, toe caps and liners. These and other products made from GEON can be brilliantly or delicately colored. They can be given a smooth or embossed surface, a dull or mirror finish. They won't crack or check because they are so highly resistant to aging. They are easy to clean because dirt and water —even corrosive acids—can't penetrate the surface.

All these and many more unusual properties can be considered in connection with a wide variety of products other than shoes: scuffproof, good-looking, practically indestructible luggage and brief cases; upholstery material that can be left outdoors because it resists the aging effects of weather; water and mildewproof fabric coatings for rainwear, shower curtains, tents; film, sheet, or coatings of GEON for packages that will resist wear, aging, chemicals, foods, tobacco, oils and greases, moisture, heat and cold.

There are applications for GEON in every phase of American life. For more complete information write Dept. U-1, B. F. Goodrich Chemical Company, 324 Rose Building, Cleveland 15, Ohio.

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Polyvinyl Materials

B. F. Goodrich Chemical Company

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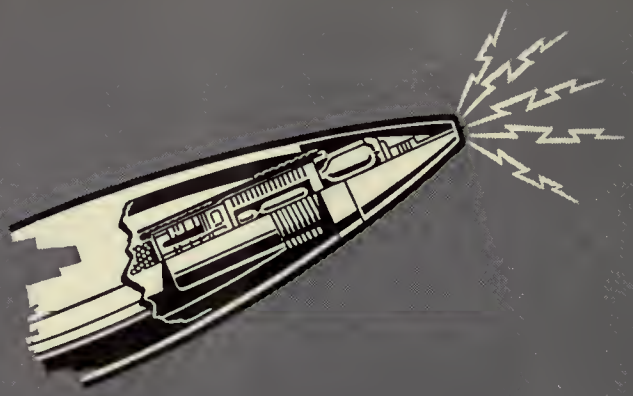

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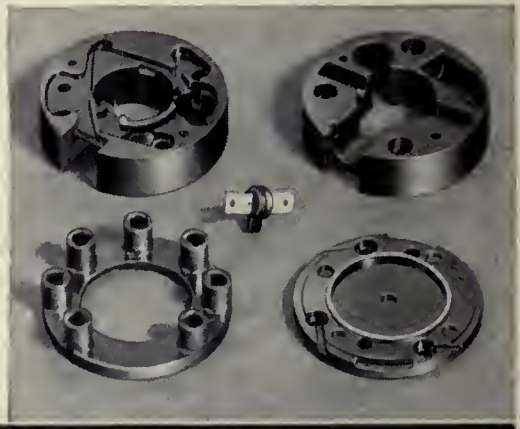
Highly intricate mold making and precision plastic molding by transfer, injection, and compression is a specialty with Waterbury Companies. Let our complete engineering and design staff work with you on the production of your plastic parts.



These small but highly intricate plastic pieces are vital parts of the now famous VT fuse.

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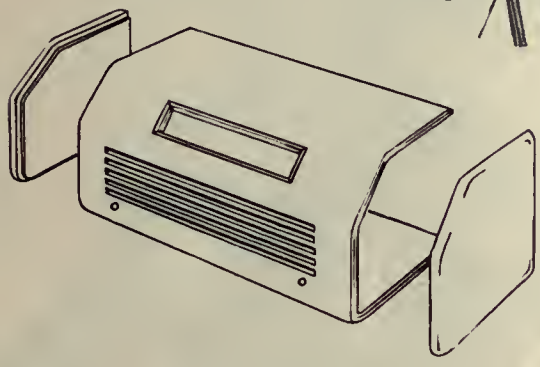
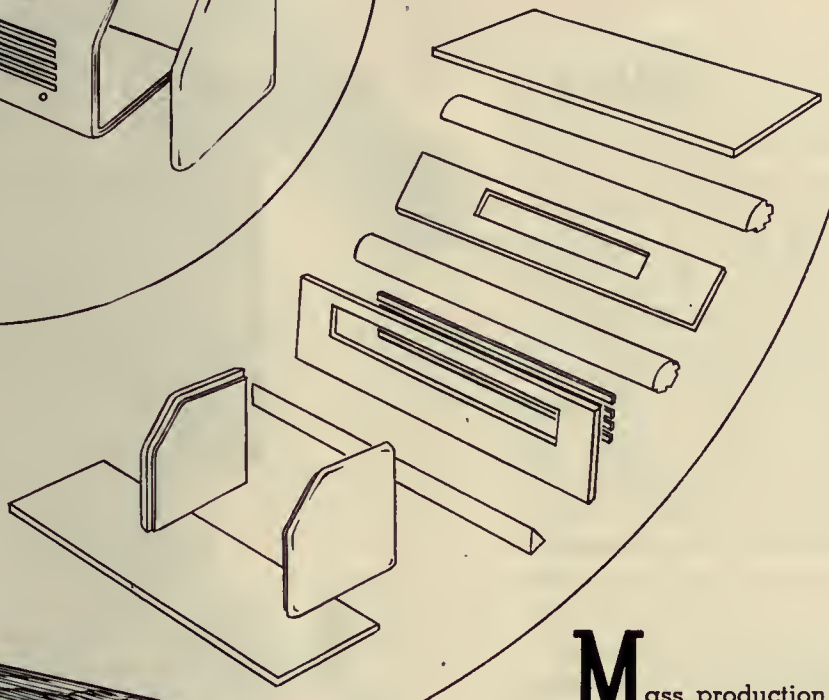
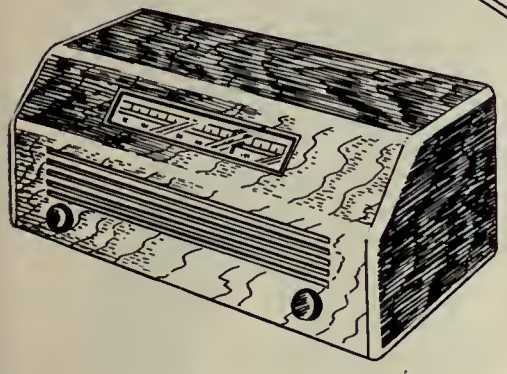
PENACOLITE

room temperature setting adhesive

3 PLUS G-1215 = 9







Mass production of fine wood assemblies is simpler, quicker and less expensive with veneers and plywood molded and bonded with PENACOLITE G-1215. Just one example of this modern adhesive's wonder working is in the production of the richly styled and finished radio cabinet illustrated here.

Note the six operations eliminated from the assembly. Note the curved shape of the casing which, when molded with PENACOLITE G-1215, will never warp or delaminate. And note, too, the surface — a paper-thin veneer which permanently endows the entire cabinet with the quality of any fine wood you may select.

For advice and assistance in applying PENACOLITE G-1215 to your production and to your product, consult PENACOLITE Division.

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PENNSYLVANIA COAL PRODUCTS COMPANY
PETROLIA, PENNSYLVANIA

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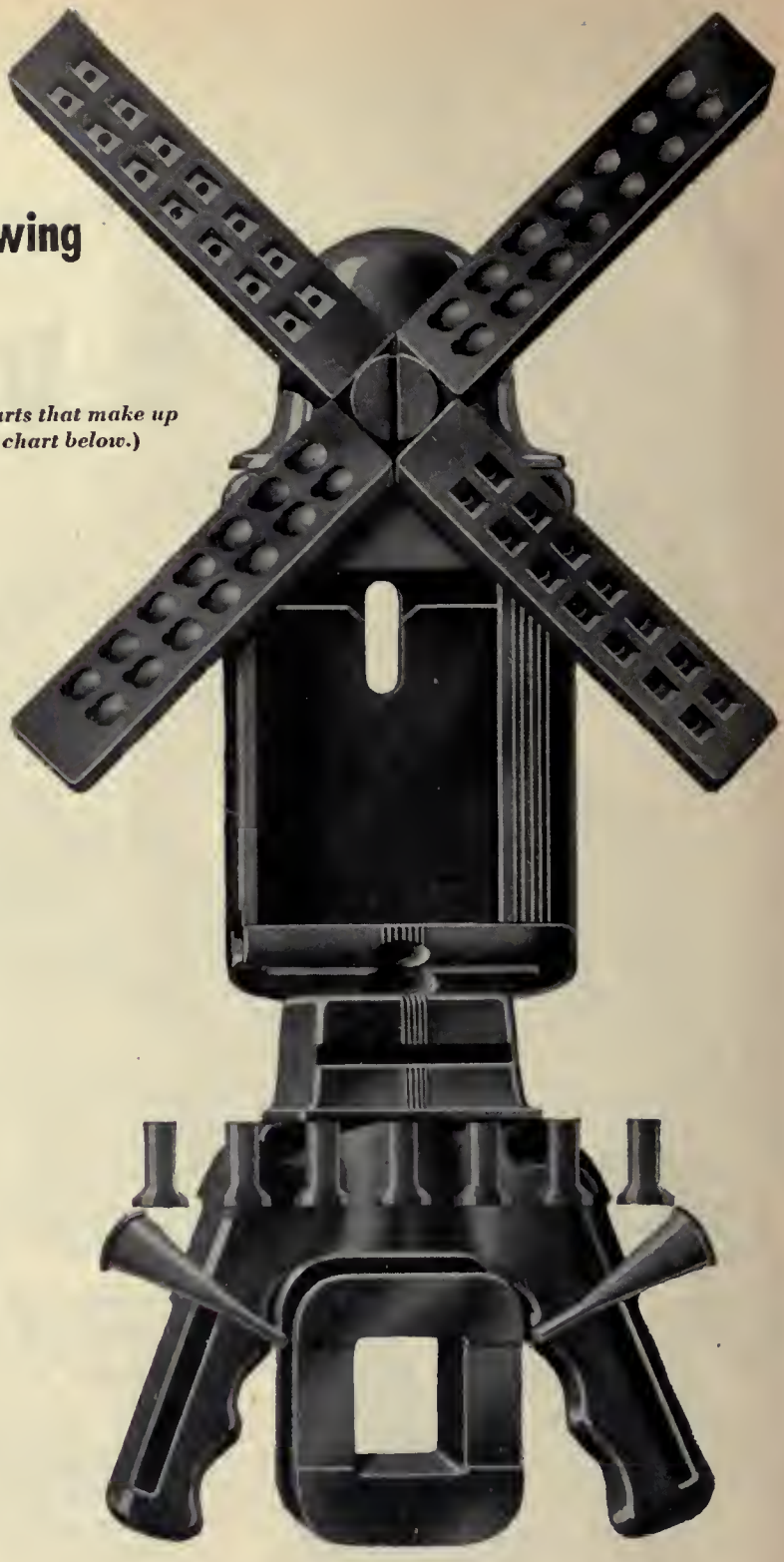
Which way is the wind blowing for your product?

(Can you name the parts that make up this windmill? See chart below.)

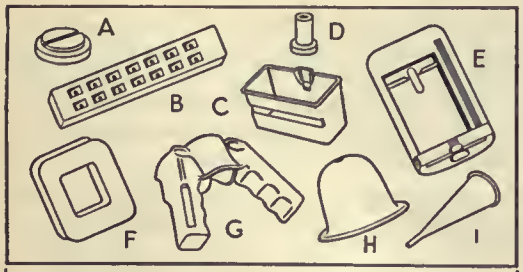


The answer lies in the windmill, itself. It was specially built to drive home an important point for you. It shows you at once the ultra-modern forms that industry demands today.

It's no wonder that many a man in industry is up in the air over products that belong with the old-style windmill days—but not with a windmill like ours. It's made of nine different plastics products manufactured at Continental Can Company's Cambridge, Ohio, plant. Its central part is a billing machine housing; its sails, 4 terminal blocks; its top, a coil housing.

Plastics are perfect for developing some products, not so perfect for others. Continental's designers and engineers will be glad to tell you honestly whether plastics answer *your* problem. If not, they'll help to prescribe a better medium.

Our mill shows just a few of the plastic products made by Continental. Long designing experience and dependable engineering "know-how" like ours are well supported with increased resources and facilities. With such an all-round organization, we can end *your* worries over bringing old-fashioned products up to date.



(A) Brush cap for motor—compression; (B) Terminal block—compression; (C) Aircraft toilet paper holder—injection; (D) Bushing—compression; (E) Billing machine housing—compression; (F) Coil form—compression; (G) Gunner's handles—compression; (H) Coil housing—compression; (I) Funnel—compression.

Other Continental Products: Metal Containers • Fibre Drums • Paper Containers • Paper Cups • Plastic Products Crown Caps and Cork Products • Machinery and Equipment

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The illustrated switch case produced by American Insulator Corporation of New Freedom, Pa. shows the product superiority achieved by Megatherm preheating. This intricate part made from rag-filled Melmac weighs 7 pounds . . . measures 15½" x 9" x 3½". It has 20 metal inserts . . . was molded to exact dimensions and flawless finish under 300 ton pressure. The cover weighing 3 pounds was molded of Durez No. 791 under 200 ton pressure.

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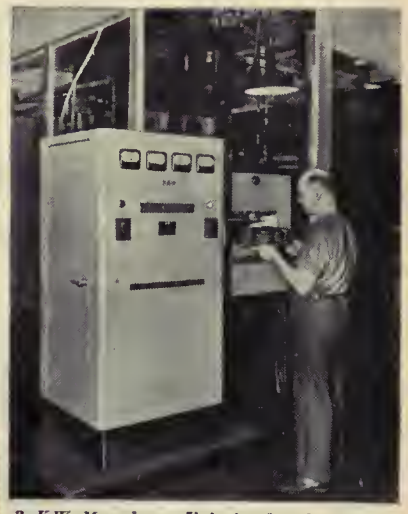

3 KW Megatherm Unit in the plant of the American Insulator Corp., New Freedom, Pa.

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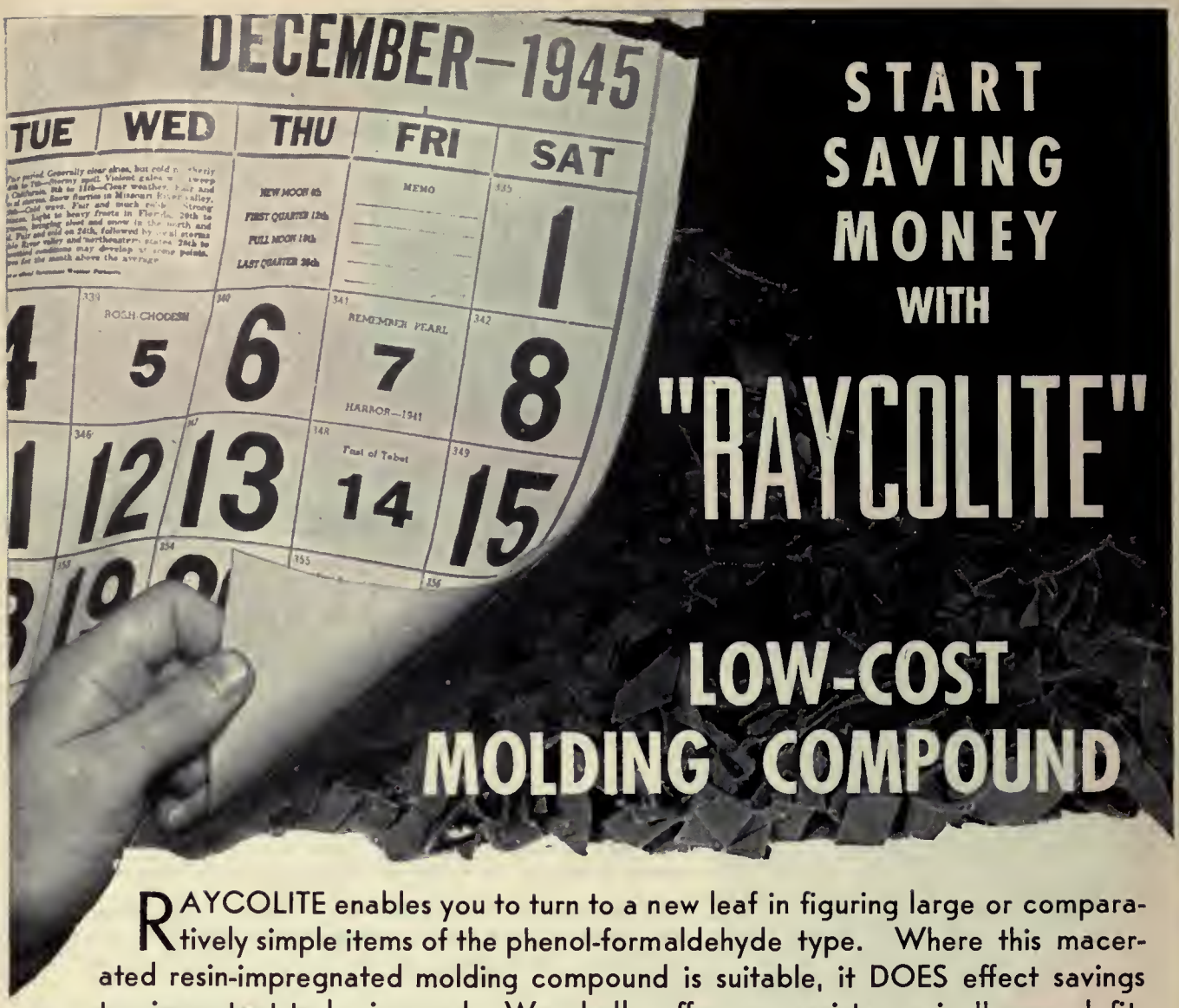

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Check *your* post war plans. Do plastic coated fabrics and papers show up anywhere in the picture?

An early contact with a reliable source of supply will give you the advantage of an early start with many of the experimental hurdles behind you.

We have the plant facilities and the experience to help you build a "quality line" right from the start. Our craftsmen were among the first to master the new and difficult technique of applying the new vinyl resins to fabrics and papers. We are one of the largest suppliers of these fabrics to our armed forces.

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Injection MOLDING

NUMBER 12
OF A SERIES

USUALLY we have plenty to say on our Injection Molding page, but this month we're going to let the pictures do the talking. The unusual looking moldings shown here may look like big compression moldings, but they're not; they're big *injection* moldings, and the tape line in the top picture indicates just *how* big they are.

They are the simulated parts of a 20-mm. gun breech, used for instruction of Navy gunners, and are made for Noel J. Poux of Tenite II by the Erie Resistor Corporation of Erie, Pa., on a 16-ounce Lester. The largest part is made of two 22-ounce moldings, produced by using an auxiliary feeder and a double shot to fill the big mold cavity.

While not designed in the manner of commercial injection molded parts, these pieces should give you an idea of the increased scope of injection molding as done by Erie Resistor on a Lester. Also shown are two 4-ounce Lesters and the 16-ounce machine, "for the big, heavy, tough molding jobs." Lack of space cuts short our sales talk this time, but if you want to know more, write today for details of the entire Lester line.

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Lesters are now built with (1) a new vertical injection cylinder, with solid plunger and internally-heated torpedo, which plasticizes more material at higher speed without burning; (2) a one-piece, cast steel, box-type frame, exclusive with Lester, which provides up to 600 tons locking pressure and eliminates the wear and weaving which are characteristic of ordinary frames; (3) greater mold opening and exact control of opening, which permits use of larger molds and speeds cycling; (4) larger diameter die height adjusting screw, eliminating possibility of mold deflection (adjustment by single hand crank); (5) automatic hydraulic ejection, standard on large machines; (6) flow control system permits separate control of injection speed and pressure; (7) new Lester safety gate is interlocked hydraulically, electrically and mechanically.

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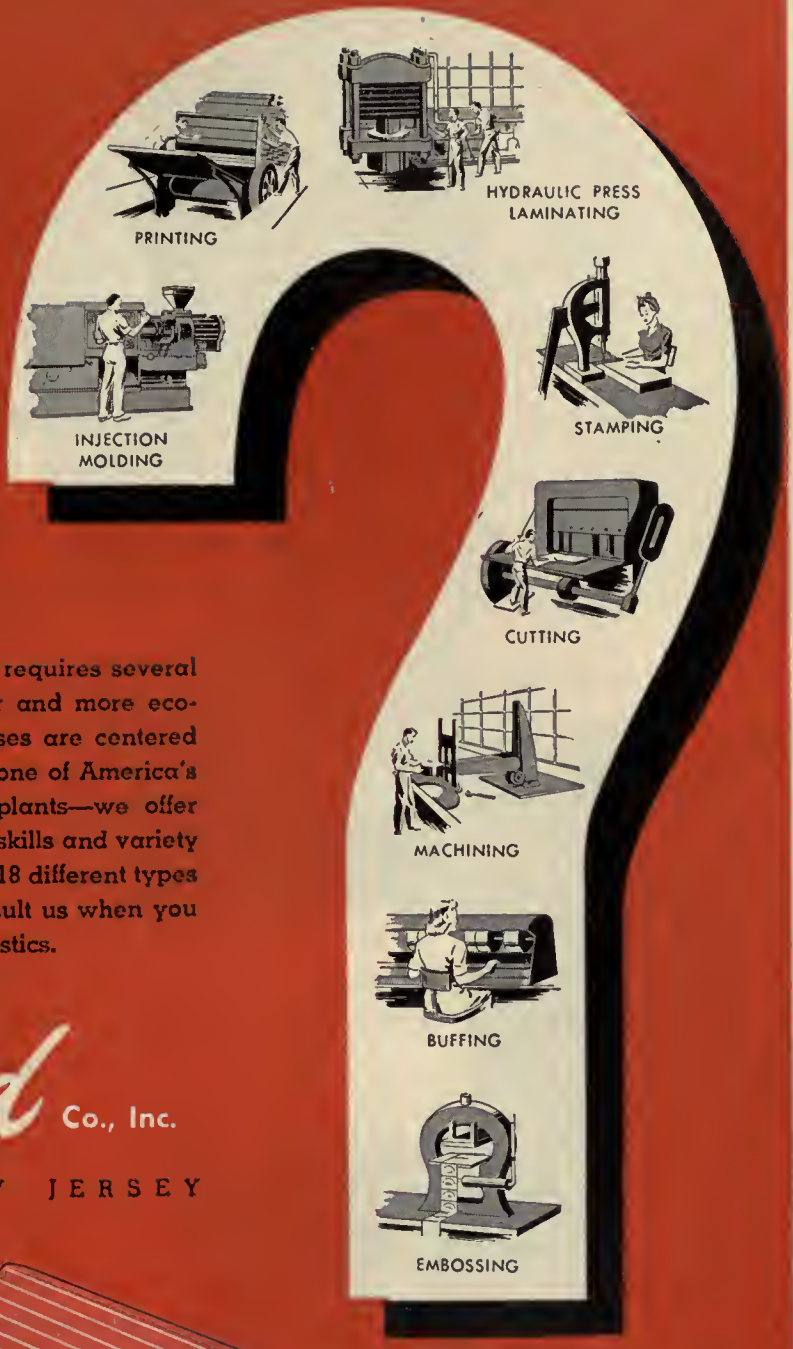

Plastic products whose manufacture requires several operations can be turned out faster and more economically when all production phases are centered at one source. Here at Emeloid—in one of America's most completely equipped plastic plants—we offer that kind of service . . . a diversity of skills and variety of facilities which include more than 18 different types of operations. We invite you to consult us when you need "combined operations" in plastics.

The *Emeloid* Co., Inc.

ARLINGTON • NEW JERSEY

This illuetrated brochure, "Progress in Plastics", commemorating the 25th anniversary of the founding of Emeloid, tells the dramatic story of Emeloid's growth and how its diversified services can perform for you. Send for your free copy . . . today!

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the Rope Fibre Plastic

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ARMY E NAVY

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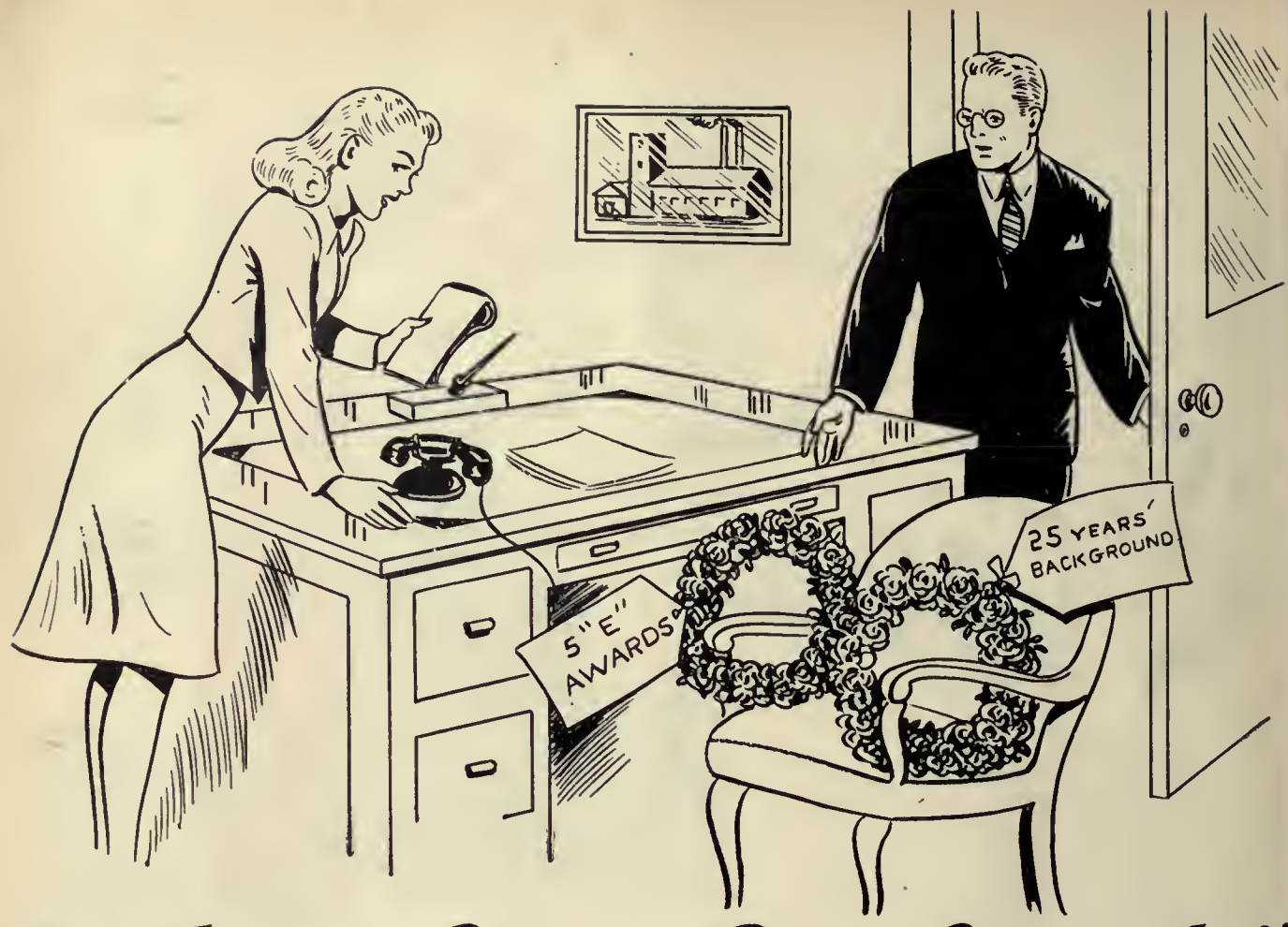

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for

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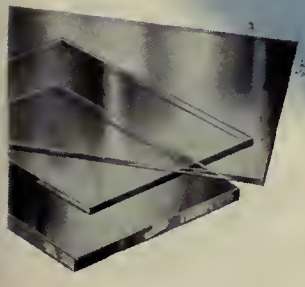

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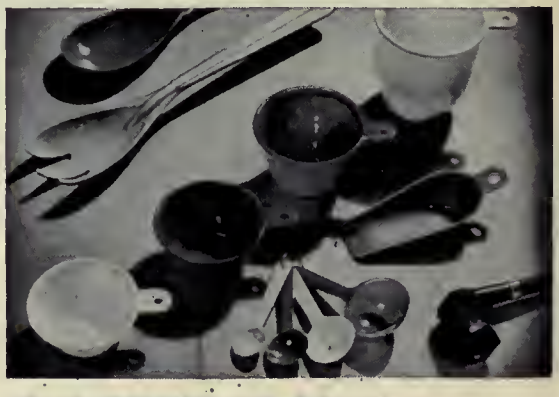

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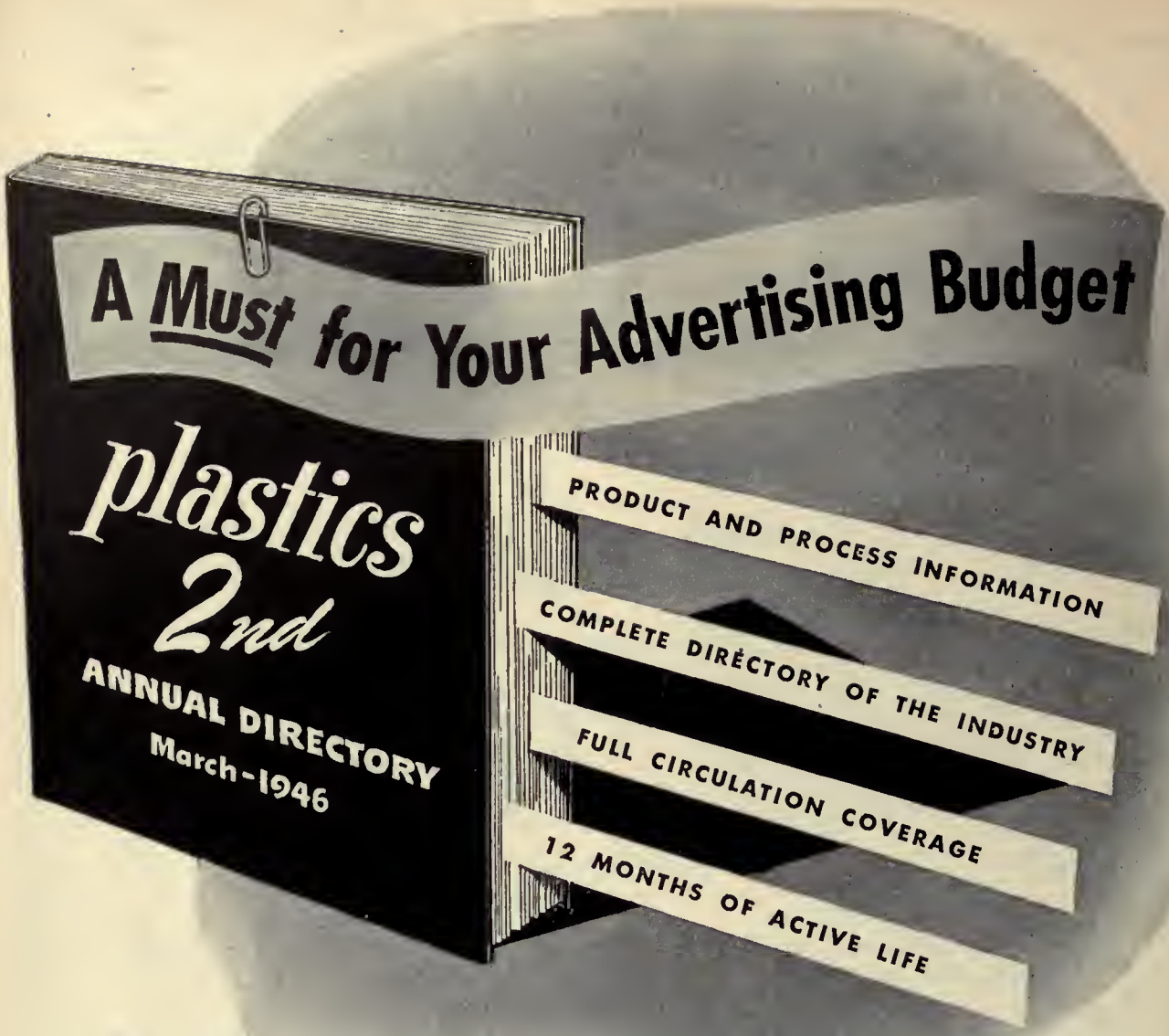

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PLASTICS in PERSPECTIVE.....

READERS of the *New Yorker* magazine have been regaled pretty often of late by quips and cartoons about plastics. One of the latest shows a booth labelled "SOYZIC, The Soybean Plastic," and the attendant tells a visitor: "It's the perfect plastics at last. It can be bored, punched, stamped, sawed, and in an emergency eaten with a light sauce." Naturally all this is in fun, and in this particular case the fact that soybeans actually are a food makes the joke sound. Sometimes, however, the reference to plastics is merely frivolous, as if the very word itself were funny, just as "Hoboken" once was good for a laugh on the vaudeville stage. The effect of ridicule is subtle. People who don't know much about plastics—and that includes almost everybody, not excepting those learned humorists of the *New Yorker*—are apt to feel condescending about materials their favorite funny magazine pokes fun at. They might hesitate before buying a plastics commodity.

We would therefore like to give the editors of *New Yorker* a short short-course in plastics. Plastics are nothing more than a new class of materials, like metals. Unlike metals, however, they are not found in nature, but are synthesized. Each type of plastics has its own properties and limitations. Maybe the editors of the *New Yorker* are in the same position as the man who had talked prose all his life and didn't know it. When they finger their shell-rim spectacles, they are touching one kind of plastics—cellulose nitrate, and the barrels of their fountain pens are probably made of the same material. When they reach for the phone, it's phenolic plastics they pick up. Their staplers, inkwells, memo pads, filing folders, desk blotters and other accessories are all apt to be made in part of one plastics or another. Most important of all, when they lean an elbow on their favorite bar, the chances are that, if it is a modern bar, it has a melamine laminate surface, to protect it against careless cigarettes and involuntarily spilled alcohol.

We do not remember any jokes in the *New Yorker* about metals. We can't place any cartoons about copper or pleasantries about polonium. If the metals aren't a source of humor, neither are the plastics.

* * *

THERE is a report circulating that some manufacturers are attempting to disguise the fact that their products are made of plastics. They are hanging fancy names on their items, suggesting that they are novelties or even perhaps new materials. They prefer, obviously, not to identify them as plastics.

Maybe this attitude is based on the premise that consumers have been prejudiced by some poorly-made plastics articles, and so rebel against all plastics. Even if that assumption is wholly true—and we must recognize that it is partially true—disguise is certainly not the way to meet the issue. Carried to the extreme, such a policy would mean the crippling of the industry, which can only grow by self-assertion, not self-renunciation. Self-assertion doesn't mean bragging of and shouting the virtues of plastics—it means taking a positive stand on their proven merits.

Aluminum came out of the laboratory into the market not by sheltering itself meekly behind the reputation of established metals. It proclaimed itself as a unique metal—for certain purposes—and it stood on its own feet. Plastics must do the same in the competition among materials. It must assert itself, not as a universal material, but as unique—for certain (and varied) purposes. To pretend to be some material it is not, or conceal itself, is to invite industrial suicide.

* * *

PROGRESSIVE factions of the industry are taking the contrary tack. They not only champion the practice of labelling plastics products as such, but they also want to bring information to the point where the consumer would realize that there are many different kinds of plastics.

This movement of informative labelling has received official approval in a recent pamphlet on the subject published by the Society of the Plastics Industry. While the pamphlet is far from a complete treatment of the subject, it is positive, and in time, and with more experience in consumer reaction, it can be amplified or modified. The difficulties inherent in this whole problem are evident by examining one example of the information recommended by the SPI committee as a basis for drawing up an informative label. This is what the pamphlet suggests under Acetates:

This is a plastic—(trade name). Tough, non-shatterable, light in weight, warm to touch, non-rusting, non-corrodible, color solid throughout, tasteless and color-fast. Wash only in warm, *not boiling,* water, with mild soap. Use no abrasives. *Avoid flame or high heat.*

What are the possible objections to this form of label? In the first place, it doesn't satisfy those who think that plastics should be identified by their chemical names, somewhat simplified to make them more palatable to the public. Thus, "acetate" would be used rather than the full "cellulose acetate." Opponents of this viewpoint could point out that, if the above type of label were generally adopted, a woman could buy eight cellulose acetate products, the material for which was purchased from the eight different suppliers; the only difference in the label would be in the trade name. This would not clarify her notions about plastics.

Actually, the above information is basic for the butyrates and for ethyl cellulose as well, so that this hypothetical customer could buy 13 articles each tagged

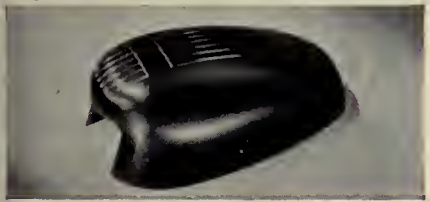
(*Continued on page* 88)

Internal Stress ?

We reduce it for better plastic parts

CUTTING 'WAY DOWN on internal stress gives your plastic application greater strength and stability under stress, as well as better dimensional stability under severe temperature change—in many cases, simplifies retention of tolerances when cooling. It produces a far better molded piece.

Like this. With the standard molding practices of a few years ago, molding this vacuum cleaner housing called for a 150 ton press. We produce it now in a 75 ton press, and



get a *better* cure and a finer finish, too. That's Heatronics (radio frequency pre-heating) for you — and only a couple of its many benefits, at that.

Let us show you how Heatronic molding can help *you*. We've been custom molders since the birth of the industry — developers of Heatronics since we pioneered its use in plastic molding. We're large enough and perfectly equipped to handle *any* job —not so large that our top men lose sight of the jobs you give us. Try us and see.

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PRECISION PARTS

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Amos Plastic Molding Jobs are Done Right

THIS NOAH'S ARK TOY—size 19" long by 9" high—is a product of Amatoy Corporation, Chicago, Ill. All parts except the animals molded by Amos. Photo by Eastman Kodak Co.

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CUSTOM *Molders of*

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From plastic toys to precision parts Amos does custom molding jobs that go into many different fields. And Amos customers get their jobs done exactly right—the way they want them—from engineering to molding and finishing.

For example the all-plastic Noah's Ark you see above is a recent Amos job for a customer in the toy field. Other jobs going through the new Amos plant include a wide variety of plastic parts and products.

With this new plant—one of the most modern in the industry—Amos facilities for plastic molding have been greatly expanded. You'll get your job done right by Amos. Just send us your drawings or write us what you have in mind to be molded in plastics.

AMOS MOLDED PLASTICS · EDINBURGH, INDIANA

Division of Amos-Thompson Corporation

SOCIETY OF THE PLASTICS INDUSTRY · SPI

Injection Molding Specialists

Such freedom of motion is allowed by the lightweight compact "Plastics Lung" that the patient can even sit up for his nourishment

Breathe Easier

By Jack D. Stratton

Lighter weight, less bulkiness, more comfort and ease of movement distinguish methyl methacrylate respirator from iron counterpart

AS A revolutionary development in the alleviation of human suffering, a new, lightweight, wearable "plastics lung" now is being manufactured to give sustained life and more comfort to victims of diseases affecting the respiratory function. Built to compete with the heavy, cumbersome, stationary "iron lung," the "plastics lung" is formed of methyl methacrylate, with the weight of the encasement worn by the average-sized adult patient actually only five pounds.

Most "iron lungs" are huge contraptions, which surround the patient's body, legs, and arms. Measuring approximately 7′ in length by 30″ in width, their size frequently has prohibited their being speedily transported, at time of an emergency, by physicians and first-aid men. In weight, these instruments range from 400 to 600 lb.

The new acrylic respirator is designed to enclose only the thorax of the patient. Arms, legs, and head are free of the breathing chamber. Dimensions are so greatly reduced that the "plastics lung" may be carried by hand like a pair of suit cases. It is easily transported by a physician or carried in an ambulance.

Weight of the mechanical unit, air hose, and three varisized methyl methacrylate respiratory chambers adds up to

The "Plastics Lung" consists of electrical plug-in, mechanical unit, air hose, "Plexiglas" jacket with fittings attached

but 60 lb. The power unit weighs 32 lb. The total for three breathing jackets is 15 lb, with the balance in weight represented by metal fittings, oxygen mask, air hose, and associated equipment.

However, there are numerous other advantages, all directly attributable to the use of plastics. Transparency of the methyl methacrylate enables physician or nurse to make optical observations of reactions manifested by the patient's chest movements, and imparts confidence to the patient by eliminating the understandable fear experienced when introduced to the ponderous metal respirator.

Warmer than metal, the acrylic sheets help substantially in maintaining room temperature within the jacket. Unheated air may be pumped, for there is no metallic chill to be overcome. The practice of quilting the interior of an alloy breathing chamber also is obviated.

Lightness of the plastics structure, together with its waist-length design, enables the patient, if his condition permits, to sit up in bed. In some cases, he may occupy a chair or stand on his own feet, while the treatment is administered. The one mechanical requirement is that he must confine his movements to the radius of the air hose, or, in exceptionally mobile cases, to the length of the hose and the electrical plug-in which supplies energy for the respiratory mechanism.

Free use of arms, legs, and head lets the patient assume comfortable, normal postures in or out of bed. And he may take nourishment or medicaments while in the breathing encasement.

Molded to Fit

The methyl methacrylate jacket, in a sense, is a garment, agreeable and warm to the touch, and light in weight. It is molded to fit the human form. Through its clear walls, the patient may observe the rise and fall of his own chest as the artificial respiration proceeds.

To those who have been enclosed for years in metal respirators and who temporarily have lost much of their capability for arm and leg movement, this new plastics device will provide a welcome emancipation.

Comparative cost is another consideration. "Iron lungs" sell at from $1300 to $1600 or more. The plastics unit will

A wax sheet is applied to frontal section of plaster pattern for use in making phenolic press dies. Below, phenol formaldehyde press dies for shaping acrylic jacket for "lung." Adults' to childrens' sizes shown

Edges of heated "Plexiglas" sheet are held down as punch die descends. Pressure of 50 psi shapes sheet

Selvages of the formed methyl methacrylate sheet are trimmed with a bandsaw to remove plyer indentations, and then run down on a three-knife jointer to correct uneven saw cuts and provide air-seal at joining point

be offered for $895, although its manufacturers say this may be lessened. Thus many small communities may be expected to equip their hospitals, fire stations, or other first aid centers with one of these life-saving pieces of apparatus.

For the one price, according to present sales plans, will be furnished the three thorax encasements, the electrical unit and air hose which supply aerated impulses for artificial respiration, and a nasal inhalator to administer oxygen. The latter appliance is so reduced dimensionally that lips and eyes of the patient are exposed.

The three methyl methacrylate jackets are designed for persons of varying chest dimensions. The smaller, weighing four pounds, is for children; the medium size, five pounds, for average-sized adults; and the largest, six pounds, for over-sized adults.

Designed to relieve patients of breathing effort, the electrically motivated control unit alternately compresses air and creates a vacuum. Air thus is forced into, and withdrawn from, the breathing chamber to establish artificial respiration. Speed of the positive and negative pulsations, as prescribed by a physician, is controlled by valves within the unit.

While electrically powered for hospital or home use, the mechanical unit may be driven from a crank turned by hand. This provision was made for drownings, other out-of-doors emergencies, and cases aboard trains, ambulances, and automobiles.

Fabrication of the "plastics lung" is a reconversion development. An aluminum waist-length breathing chamber previously had been manufactured in limited quantity. Cast in sand, the aluminum jackets respectively weighed five, eight and 12½ lb, considerably more than the acrylic jackets weigh.

Plastics Lends Advantages

Patents covering the aluminum device were acquired by California Aircraft Engineering Co., Los Angeles. The president of this company, Harry J. Coffman, understood application of Rohm & Haas *Plexiglas* from experience gathered in fabrication of bomber noses. Further, it was recognized that methyl methacrylate would lend many advantages to the respirator assembly, now about to be marketed to the United States and Europe under the tradename *Blanchard Mechanical Physiotherapist.*

In taking this material into consideration, it was pointed out that the sheet may be formed and machined easily, that it possesses strength, and that it has high optical quality. In addition, it is stable in prolonged service and is odorless.

Production of the methyl methacrylate breathing chamber, assigned to the Nu-World Products Co., Huntington

"Plexiglas" lung jacket, with front and back sections in position, gets polishing to remove dust particles

Beach, Calif., a concern formed since end of the war for fabrication of plastics items, involved several problems.

The jacket was to consist of two acrylic sheets, one to cover the chest, the other to enclose the back, of the patient. These sections required an air-seal closure where they joined, and it also was necessary to effect air-seals, through use of rubber sheeting, at the waist-line and at the holes for neck and arms. To maintain optical properties, the shaping process had to be performed without scratching the material, and it further was desirable, as well as economical, to produce a one-piece pressed sheet for each section of the jacket, and that these sheets possess flanges for fastening the rubber closures at the arms and neck openings.

Stretch forming on a steel die briefly was considered. But although such precautions as covering the metal die with flock rubber cloth or some other protective fabric could be taken, surface abrasions upon the acrylic surfaces might occur.

The process also would require flanges to be formed separately and cemented into position, a process entailing extra work hours and leaving cement lines to obstruct optical studies of the patient and mar the appearance of the finished product.

For these reasons, Cecil T. Weaver, Nu-World's vice president and shop superintendent, formerly in experimental work at Rohm & Haas' South Gate, Calif., plant, made it a one-piece press job by going into production with phenol-formaldehyde press dies.

Plexiglas sheets used in the process are 3/16" thick. Surface dimensions of the unpressed sheet for the child's thorax encasement are 18 by 20", for the medium adult's 21 by 25", and for the oversized adult's 25 by 27".

Acrylic Properties Preserved

Extreme care to preserve the plastics sheet's optical properties is exercised throughout. Protective paper coverings are stripped from the sheets only when ready for heat treating. Canvas, upon which the sheets repose in the oven, frequently is cleaned of any microscopic foreign fragments, which might cause an infinitesimal surface abrasion.

For the heat treatment, a "home constructed" drawer-type oven is utilized. The sheets are given 20 min in a thermostatically controlled temperature of 275° F before being pulled for shaping.

Both sections of the unheated phenolic press die are spread with a specially prepared lubricant, based on a formula developed by Weaver. This oil serves as a parting agent, and guards against any chance blistering of the material.

In transferring the heated sheet from oven to press, plyers are used on the four corners, contacting only the selvages, which later will be removed. A pressure of 50 psi then is exerted by the press for six minutes.

Oil adhering to the molded sheet after the forming process is removed in a four-phase cleansing operation performed in a wash tank. First step is a kerosene bath to cut and remove the greater part of the lubricant. *Triton X-300*, the sodium salt of an alkylated aryl poly-ether sulphate, a solution containing 20% solids dissolved in water and isopropyl alcohol, a Rohm & Haas product, next is applied as a detergent. It eliminates the remaining film of kerosene and oil. A water rinse follows, after which the pressed sheet is blotted dry with absorbent paper.

Selvages, marked with plyer scars, are trimmed by a band saw, after which the sawed edges are run down on a Delta three-knife jointer. The jointer not only corrects uneven saw-cuts, but provides the essential air-seal where contact takes place between edges of the two jacket sections.

From this point, usual shop practice prevails. Screw holes are drilled for suit-case type clamps, which will hold the chest and back sections in contact. Bolt holes are bored for attachment of the rubber air-seal waist-band. For this work, an ordinary hand drill is employed.

Ethylene dichloride, furnished by Los Angeles Chemical Co., is used to cement in place several acrylic reinforcements, which lend strength to the screw threads, and to affix acrylic knobs, which will serve as tie-offs for the rubber air closures. Screws and bolts, used in the assembly, are of the design applied to acrylic bomber noses of certain airplanes, and were bought from military surplus.

(*Continued on page* 129)

The "Plastics Lung" offers more comfort, allows freedom of movement. Medium size jacket shown weighs 5 lbs.

start with Tenite

Starter pedals molded of Tenite equip Harley-Davidson motorcycles. The plastic pedal is tough and durable and successfully withstands the kicks of heavy heels. Replacing steel-tube starters, the Tenite pedal has a colorful, permanent finish which requires no protective coatings against corrosion. The extremely light weight of Tenite is also an advantage. Since speed of the motorcycle depends to a large extent on its lightness on the road, the weight of all accessories must be kept at a minimum.

Grips, lamps, chain guards, and horns for motorcycles and bicycles were popular pieces of prewar equipment molded of Tenite. Once again, the use of Tenite for such products as these is unrestricted. Get an early start by writing for further information on Tenite to

TENNESSEE EASTMAN CORPORATION
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KINGSPORT, TENNESSEE.

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Starter pedals molded by Sobenite, Inc., for Harley-Davidson Motor Company.

ry pigment and varnish are mixed to make printing inks

Producing Better Printing Inks

nting directly on glass containers offers excellent eye appeal

THE tremendous changes created by plastics materials in many industries make a familiar story. What is not so well known is the revolutionary transformation produced by synthetic resins and new processes in the manufacture of inks, not only for printing letters on paper but also for imprinting patterns and designs on fabrics, plastics surfaces, and other materials. In this development, resins of every type have made their contribution.

The composition of ink played a decisive role in the development of printing. The ancient Chinese, who were the first to make printing materials, obtained their inks from natural substances like plant-roots, colored earths, and soot. It was not until the 15th century that Dutch and German painters discovered that linseed oil, when well boiled, produced a varnish of excellent body with binding and drying qualities. This varnish was mixed with lamp black to form the first printing ink.

Printers used this ink for centuries with no substantial change in composition. Up until the first World War, in fact, the only improvements were in color and drying qualities. Drying speed was accelerated by the use of metallic driers (the salts of lead, cobalt, and manganese). For newspaper ink, less expensive mineral oil took the place of linseed oil, as the ink dried by rapid absorption of the oil into the porous paper stock, instead of by oxidation.

It was not until the years following the end of the first World War that a fundamental change occurred in the art of ink making, and this was due largely to the development of plastics. The unchallenged tradition of linseed oil as the chief ingredient—a tradition that had been accepted unquestionably for 500 years—was broken at last with the discovery that oils could be effectively replaced by natural or man-made products specially formulated for the particular

By Philip Pollack

How synthetic resins, solvents have changed art of ink making, leading to new inks that print better, dry faster, last longer

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printing process required. Synthetic resins in combination with newly developed organic solvents created vehicles and binders for inks that resulted in superior printing and drying qualities.

The chief contribution of the new process was in stepping up drying speed, an important factor in modern printing. Linseed oil dries by absorbing oxygen from the air, so that the print dries by itself in the traditional method. Unfortunately, however, the rate of drying is not constant but varies considerably, depending on weather conditions and paper peculiarities. This may cause a protracted drying period, a serious handicap in present-day speed printing, especially when the paper is printed on both sides.

The importance of this factor can be appreciated when it is considered that printed paper must be protected in its wet stage from possible smudging and "offsetting" (which means the unintentional transfer of wet ink from one page to the adjacent one). In order to avoid the smudging, the paper must be stored away for drying. As the drying period varies unpredictably, in many cases, the printer cannot guarantee delivery at a specified time. This factor limited printing speed, held back production and boosted costs.

For several years, ink makers had been wrestling with this problem by experimenting with "heat-set" inks. These dry, not by oxidation, but by evaporation of the volatile solvents through the application of heat. The principle was first applied in gravure printing, in which printing is done from revolving copper cylinders or etched plates. The ink vehicle used was a combination of synthetic resins and nitrocellulose dissolved in very low boiling solvents having a fast evaporation rate, such as ethyl acetate or methyl ethyl ketone. Quick evaporation of these solvents results in speed-drying, and no waiting period is needed as when linseed oil is used.

The new method has made "gravure" the leader in fast printing of high quality. One Sunday edition alone uses as much as 105,000 lb of gravure inks. Heat-set inks have proved successful in the magazine field, also, where press speed is imperative for mass production. The hitherto unprecedented speed of 1000 ft of "web" stock a minute can be achieved in consequence. Thanks to plastics in ink, considerable time-saving is effected also in the manufacture of packages and bags, as the printed containers, quickly dried, can be conveyed immediately from press to fabricating machine.

Quick drying is only one of the many qualifications of a modern printing ink, which is essentially a special lacquer composed of base, solvents, and pigments. As examples of numerous other desired properties, solvents must be such as will not be a definite fire hazard or explosion risk, and pigments must be bleachable where paper is to be re-pulped and re-run.

The invasion of plastics into the ink-making industry in the last 25 years has fostered the growth of chemical research laboratories. In these, hundreds of resins are regularly tested for possible application in the various fields of printing. The earliest chemicals used in this connection were glycerine and rosin. For certain varnish formulations the phenolics were found to be superior. The alkyd resins and oils, it was discovered, produce inks that dry fast and hard. For printing on surfaces other than paper, the urea-formaldehyde resins proved unusually effective.

In general, all plastics materials used in the paint industry are employed in ink manufacture. However, only the highest grades are selected, as ink requirements are much more severe. Chemically pure pigments are used exclusively and they are not diluted, whereas the cost of paint is lowered, for example, by reducing the concentration with inert white to 30 or 60%. This is too coarse for ink as it would result in a scratching of the printing plates and a lessening of affinity of the vehicle for the printed surface.

According to one authority, the alkyd resins are used considerably, as they create tough films. The modified phenolics are also extensively employed. Selection of the proper resin is based largely on the cost factor, which be-

Instrument measures rate of flow of printing inks

When desired pigments are not on the market, laboratory workers make them

"Ferris wheel" apparatus is used to test evaporation rate of printing ink solvents

comes crucial in the manufacture of the "bread and butter" inks used in ordinary printing. The acrylates and vinyl resins are used in the more expensive processes. Where printing stability and drying and not toughness of the film are the chief requirements, a saving may be effected by the use of a cheaper resin.

For printing on packaged food and bread wrappers, the steam-setting process is employed. This requires a water-miscible resin and solvent, like rosin-modified maleic acid and glycols. This method creates an ink that is odorless and tasteless, prime requisites for packaging.

The faster drying resulting from the use of synthetic resins has led to the replacement of slip-sheet printing by web-printing in a continuous process, and production time has been slashed in consequence. But synthetic resin inks have other advantages: they are rub-proof; have cleaner, more concentrated color; and have better press stability. They also give more "mileage;" whereas, formerly, 500 lb may have been needed for a day's run, only 400 lb are now required because, being more stable, the ink does not dry up on the rollers.

The best printed surfaces have not only glossy finish but hardness and resistance to scratching and smearing. Plastics enable inks to achieve these properties. The exact formulation is a specific problem in each case, the requirements of the ink differing widely in typographic, lithographic, and gravure printing. There is, for example, little similarity between the quick-drying ink used in web-fed rotary presses and the ink needed for a sheet-fed press, although synthetic resins are used in both processes. For printing on surfaces subject to rough handling (cartons, containers, books, magazine covers, etc.), inks that are scratch-proof and rub-proof are needed. It is the toughness that resins in general impart that make them particularly valuable in this connection as ink ingredients.

In the development of inks for printing colored designs and patterns on fabrics, synthetic resins have also played a stellar role. For this purpose, the fixing agent traditionally employed was blood albumen. The drawback of this method of fabric printing was that the design was not fast in washing because the pigments did not bond permanently with the fibers. About 15 yr ago, a method of lacquer printing became popular. Pigments were dispersed in nitrocellulose or ethyl cellulose solution and were applied to the fabric by the conventional type of printing machine. Designs were more fast by this method, but the fabric became stiff in the printed parts.

It was not until 1938 that Aridye Corp. used synthetic resins in a new process that lifted fabric printing to unprecedented levels of efficiency. Urea formaldehyde and alkyd resins were utilized as bonding agents for pigmented emulsions of the water-in-oil type. The result was brilliant pigment prints which could withstand repeated laundering and dry cleaning and the pigments were fast to light. With this process it is possible to achieve exact reproductions of engravings, a quality which makes it superior to soluble dye methods.

Various modifications of the process have since been introduced. In all of them, synthetic resins like urea formaldehyde and the alkyds are employed for bonding the fibers. Other resins used are melamine formaldehyde, the phenolics, the vinyls, and cumarone resins. The hydroxy-cellulose ethers are used for dyeing with pigment colors and, to a lesser extent, in printing.

In the so-called "discharge style" of pigment printing on textiles, ethyl cellulose is employed as a bonding agent for the pigments. The fabric is first dyed in a solid shade, and the pattern is created on a printing machine by the use of a discharge agent like hydrosulfite which destroys the color applied by dyeing. At times coloring material is added as well.

One advantage of ethyl cellulose is that it provides a stable emulsion. It is used either alone or in combination with rubber or other synthetic resins. The employment of emulsions in the printing and dyeing of textiles is, comparatively speaking, an innovation. Traditionally, textiles have been dyed almost exclusively through aqueous solutions of dyes and the printing done through pastes and the incorporation of soluble dyes in the paste. In the most successful methods, which have made use of plastics, the results have been the production of prints that are water-repellent to an extent unknown before, fast to light, laundry-proof, and resistant to washing solutions, as well as to dry cleaning. All these effects are achieved without injury to the fabric.

The new inks made their entrance, also, in the field of printing on plastics surfaces. For this purpose, rotogravure, lithography, letterpress, aniline, and silk screen processes are all available. In each process, a different type of ink is used, and it is the problem of the plastics fabricator to select the method and inks best fitted for the particular purpose. Letterpress inks, for example, may contain either alkyd resins, the phenolics, the ureas, the vinyls, etc., in which organic and inorganic pigments are ground, the exact formulation depending on the binding or drying requirements and other factors. In aniline printing, an important requirement is that the ink dry almost instantly because the printed materials are either re-wound or processed immedi-

This four-color Claybourn press constitutes a proving ground where process inks for wet printing are tested

Red ink pouring from mill runs through from three to twenty times, depending on properties desired

Newly-developed synthetic resin inks make possible the printing of "labels" directly on glass bottles

New method of printing "labels" by-passes costly manufacturing step by eliminating need for paper

After being printed by the Anagraphic process, bottles are placed in oven for heat to set synthetic ink labels

ately. Both aniline and rotogravure printing methods are used in printing on cellulose acetate and cellophane surfaces. On the other hand, plastics lipstick containers and vanity cases present attractive decorations which are imprinted by the silk screen method. Inks used in this process must adhere firmly to the surface and not rub or crack off. Silk screen inks are divided into oil, water color, and the synthetic types. For plastics surfaces, the synthetic kind has been found to be superior in performance.

Varnishes used for these inks are oleoresinous or binding ingredients, including nitrocellulose, ethyl cellulose, the alkyds, and resins like phenol formaldehyde, the vinyls, the acrylics, polystyrene, etc. These are dissolved in solvents such as alcohols or esters, either individually or in combination, depending on the drying time required and the type of plastics surface to be imprinted. Maximum milling of the pigmented ink is necessary in order to eliminate any coarse particles that would tend to clog the pores of the silk screen, as the imprint is made by squeezing ink through the pores of this screen by means of a rubber squeegee drawn across the surface.

At present, the chief demand in printing on plastics is for silk screen inks with quick-drying properties. The problem is to formulate ink that will not dry quickly at room temperature or form hardened film on the silk screen. The inks may be either liquid or viscous and dried by heat-application, depending on the kind of plastics surface. Some thermoplastics may not be able to withstand the high temperature baking needed for accelerated drying. Furthermore, the hazards to which the plastics products are exposed are an important consideration in the selection of the ink. Many fabricated plastics, for example, are used in the manufacture of motorized equipment and electrical appliances. The ink required for printing in these cases must, therefore, be resistant to gasoline, oils, alcohols, acids, etc.

So far, the application of ink films to plastics surfaces is in its laboratory stage of development. Research with synthetic resins of various kinds is proceeding steadily. International Printing Ink has solved many specific problems in this field for plastics fabricators, but, as pointed out by John J. Micik of its research staff, the collaboration of the plastics and ink industries is necessary to effectively investigate and solve the many problems involved.

The inks now used on thermoplastic sheetings are for the most part modifications of the oil base inks that have been used for years in printing on paper. The new types are making definite headway, however. Typical are the ethyl cellulose inks employed for printing on ethyl cellulose, which has a high capacity for absorbing high boiling solvents. On account of their high boiling base, the inks dry very rapidly on this plastics but are extremely stable on the press at room temperature.

An interesting new process is that of printing "labels" directly on to glass bottles. Anigraphic Process, Inc., is one of the very few companies doing this work. Printing in this fashion cuts down production costs and, consequently, is cheaper than printing a paper label which in turn has to be pasted to the bottle. With the Anagraphic method, ink flows directly on to the glass bottle and appears to the eye like a paper label. One machine developed for use with this method can print fifty bottles a minute.

What is the prospective market for synthetic resins for printing ink of all kinds? One indication is the estimation of $50,000,000 worth of ink sold in the United States annually. Products of ink manufacturers rose in value from $14,000,000 in 1914 to $47,000,000 in 1937. It was estimated that, for newspaper printing alone, the value of ink production in 1939 was $7,000,000 to $9,000,000.

It should be borne in mind, in this connection, that demand for synthetic resins in ink manufacture is in its in-

(*Continued on page* 123)

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FORTICEL is a cellulosic thermoplastic. Chemically it is *cellulose propionate*. Physically it possesses what is perhaps the best balance of desirable characteristics obtainable from commercial thermoplastics. Its outstanding properties are toughness, low humidity expansion and brilliant surface finish.

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Forticel has the color beauty and touch appeal of the cellulosics. It is odorless and non-toxic—ideal for personal contact items—particularly those which are subject to extensive wear.

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Forticel's excellent molding properties will be important to the designer and manufacturer as well as the molder. Practically invisible weld lines and great weld strength will simplify product design. The injection molding cycle—generally shorter than other cellulosics—and the wide molding temperature range will mean faster and more economical production. Forticel is compatible with cellulose acetate butyrate, but is not miscible with other cellulosics.

The addition of Forticel greatly enlarges the field of usefulness of the Celanese family of thermoplastics. By January first Forticel will be available for tests on selected applications. Increased quantities will be produced as rapidly as new plant facilities can be put into operation. Celanese Plastics Corporation, a division of Celanese Corporation of America, 180 Madison Avenue, New York 16, N. Y.

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MOLDABILITY	Molding cycle is generally shorter than other cellulosics . . . Uncritical molding temperature ronge

These plastics-coated fabric bags are sturdy, smart, attractive, medium-priced

And Now It's Luggage

By Barbara Baer

THE leather industry, having seen its once sacred domain invaded in many fields by the newcomer, vinyl plastics sheeting, is now watching the young competitor step briskly into what seemed to have been its final stronghold—the luggage field. For, although vinyl sheeting has already been widely used in shoes and handbags and has made considerable inroads into applications ranging from binocular coverings to upholstery, it is only in recent months that a major luggage house has offered a complete line of "plastics luggage." The firm is the Boyle Leather Goods Company, Inc., which has been in the leather luggage business for almost a century.

Released to stores early this spring, the Boylastic Luggage line has been increased gradually until it now comprises seven styles for women and nine styles for men. Simulating some grades of leather so exactly that experienced luggage buyers are said to have difficulty in distinguishing between the two materials, the new bags combine durability and light weight at what is considered to be low cost.

After laboratory research had resulted in both a vinyl compound with suitable properties and proper thickness, and a compatible backing cloth of correct thickness, the company was faced with the problem of obtaining a leather-like grain. Technicians concluded that a simulated grain, which in effect is a pre-scratching of the surface, would serve the purpose better than a plastics patent leather effect. A clue was provided when Boyle, because of transportation difficulties, was compelled to replace the rare West Indian satinwood used in their line of brushes. At that time officials discovered that the wood finish might be simulated photographically on the brush backs by a photoelectric process. Similarly, the graining could be photographed on the plastics sheeting while it is still in a semi-elastic state.

Extensive testing before the luggage was placed on the

(*Continued on page* 124)

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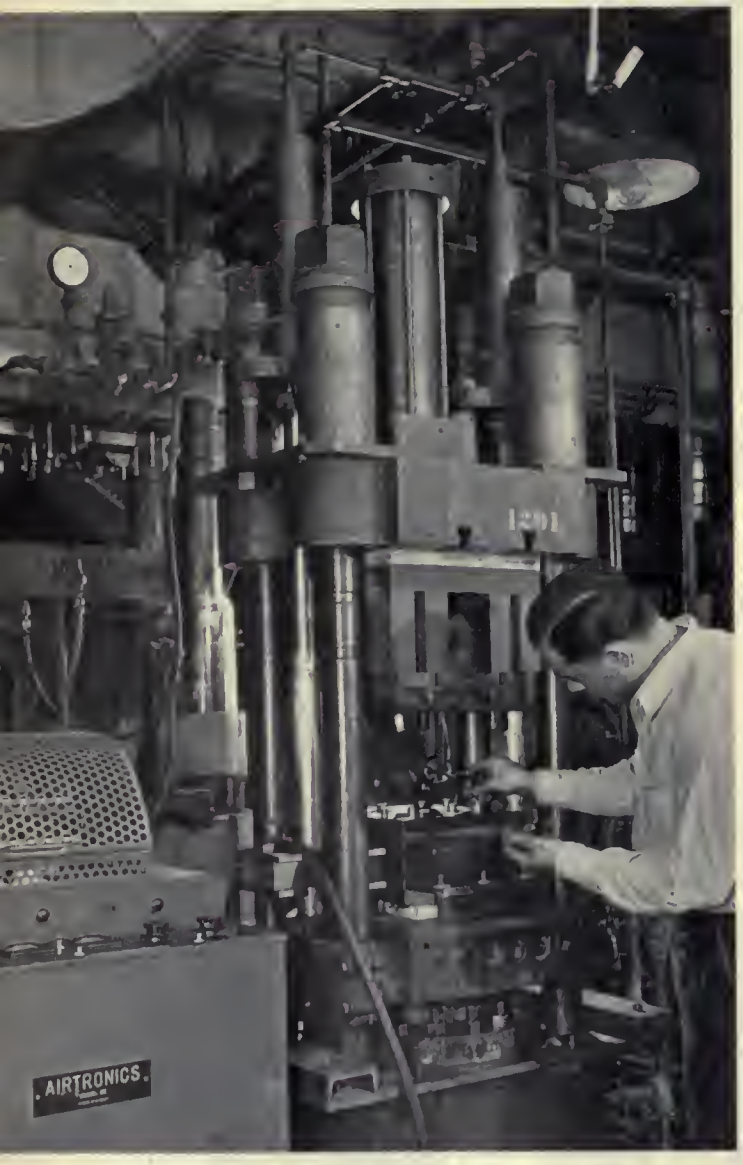
Reconversion in the Molding Plant

Efficient peace-time operations demand careful re-study of plant lay-out, equipment, materials, methods, personnel, and markets

By J. H. Du Bois
Executive Engineer, Shaw Insulator Company

ALTHOUGH a molding plant does not have to be completely overhauled to make it ready for peace-time production, it nevertheless has genuine problems. Anyone who thinks it is merely a question of substituting a peace-time item for a military product is going to be swiftly and sadly disillusioned.

For the molder, reconversion means re-study: re-study of his equipment; re-study of his personnel; re-study of the materials available; even re-study of the jobs he once mastered, for refinements in technique have a way of being lost when they are not constantly used. Above all, the molder has to re-study his organization as a whole to meet the competition created when war production ceased.



Auxiliary ram converts old-style compression press for use with pressure type transfer mold, resulting in more efficient operation. High frequency heater is also new

In the last few years most molders have operated without sales engineers, and their product engineering was virtually non-existent because war jobs were essentially long running jobs. Peace-time requirements will require greatly expanded organizations because of the greater number of jobs needed to maintain the same dollar volume. Profitable operation and satisfied customers result only from the careful planning and complete engineering of every job. This necessitates the development of an adequate and experienced engineering staff qualified to do the necessary product design, tool engineering, plant engineering and production control. Smoothly running organizations do not happen—they require careful planning and training. The few fully qualified engineers left in the organization must spend a large portion of their time in the training of others to do the individual jobs.

Training Is Essential

Of equal importance is the establishment of a training program for the future since the industry is short of skilled personnel. A business that expects to expand must plan a training program to develop the engineers needed for sales and engineering work. A good plastics engineer requires experience in the tool room, molding shop, tool design and product engineering sections; a planned training program will see that the young engineers get the proper experience in each, so that they will be qualified for the responsible positions as the organization expands.

Of equal importance is the training of supervisors and foremen. You cannot make a good foreman simply by pinning a foreman's badge on a willing worker. He also must be trained to meet the engineering and the personnel problems. The best of plastics engineering will fail if the human engineering is neglected.

In starting reconversion, it is essential to review all of the peace-time production equipment. Worn and broken tools should be replaced or repaired before production starts again. In many cases, new war-time developments or improved designs may indicate the desirability of completely new production equipment to achieve lowest costs and production continuity. New materials must be evaluated; perhaps one of them may be better and cost less for a particular job than the materials previously used. Unless the molder makes this study and offers his best at all times, some competitor may come in with the new idea and take the account away. The recently developed materials offer unlimited prospects for new products and users. Each new material should be broken down into potential products so

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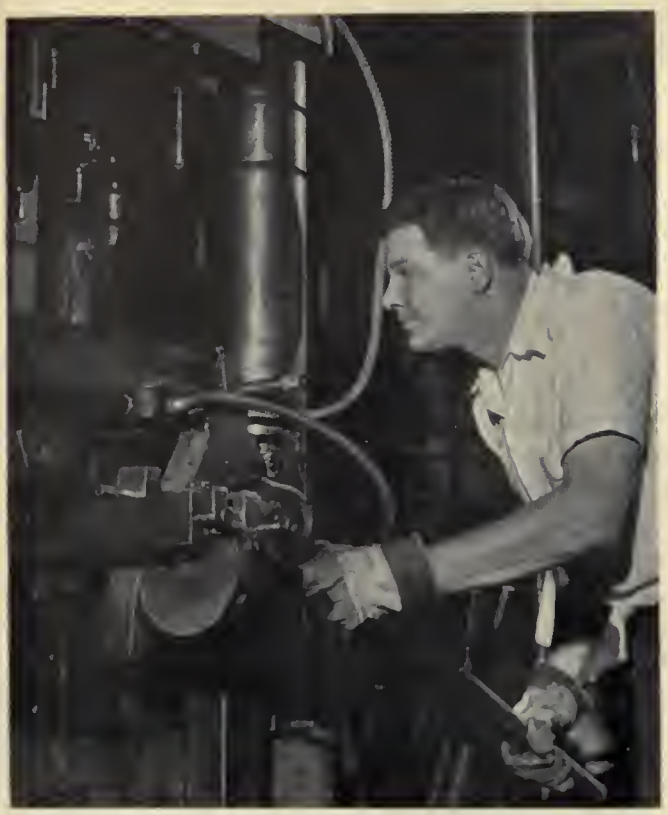

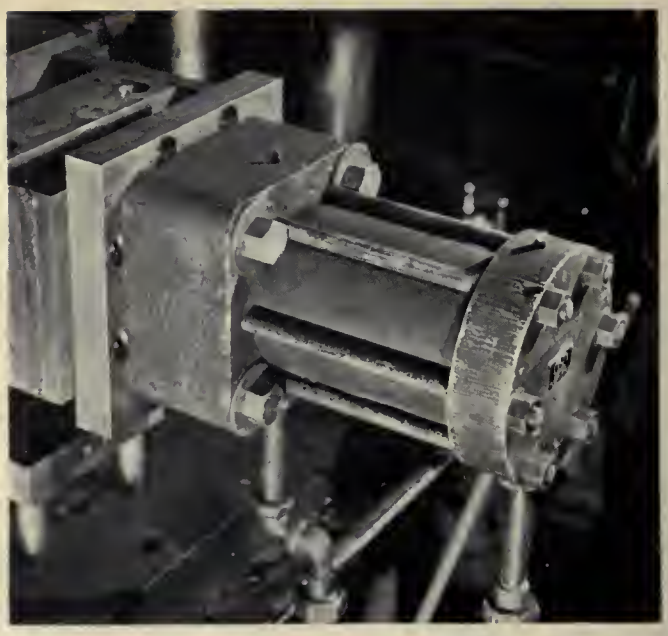

Hydraulic cylinder added to press for pulling the cores eliminates the time-consuming and tedious process (left) where the operator must remove safety locks, unlock wedges, move them, and lower the cavities, then re-do operations in reverse for loading

that the logical customer group may be reached for the market development.

New customers must be found to utilize the war-time expanded capacity, and this involves many studies. Certain proprietary products that are produced largely of plastics may be undertaken as a basic manufacturing project. The manufacturer may elect to concentrate his energy on improved manufacturing techniques and maintain a satisfactory income on a decreased volume of business.

Markets Must Be Reviewed

New and improved processes, machinery, or materials may lead to the revival of old projects and the opening of markets once considered unpromising for plastics. Back in 1927 a serious study was made of the shoe heel business as a potential market for molded plastics. Every known material and method were tried. The thermosetting materials and molding methods were just not suitable and, as a result, the shoe heel project was tagged as impossible and all further work abandoned. A customer who was unaware of these past failures, however, came in about ten years later with a new approach, and a re-study of the application was made. During the intervening period, the thermoplastic materials had come in, along with injection molding and the problem then was very simple.

All of which goes to prove that we must maintain files of desirable markets and *review these files frequently in the light of current developments.* We become prejudiced far too easily by previous experience, and the "fool who did not know it could not be done goes ahead and does it."

The mechanical problems are the most easily handled of all if the engineering staff is adequate. Old presses must be rebuilt for faster operation. All of the planning should be directed toward the mechanical devices and helps that will enable the press operator to turn out more goods with less physical effort, so that he can earn additional compensation by extra production. Preheating devices, automatic timing, semi-automatic molds, uniformity of valving, insert loaders, convenient press arrangement: these are a few of the engineering helps that will increase production capacity.

It may often be necessary to re-study plant lay-out for the best possible utilization of space and the least handling of raw materials and finished products. In some cases, rather expensive rearrangement of plant machinery and equipment may prove to be economically sound in the long run. Though American industry has a well-deserved reputation for efficient line production, it is not entirely free from the wastefulness of "picking things up and putting them down" too often. This situation is very likely to exist when companies experienced a mushroom growth during the war, and installed another production unit in any odd and unused corner to get it into operation as quickly as possible. After all, that was more important during those critical times than securing optimum efficiency from the use of the machine.

Regaining "Lost Art"

Some problems will arise in reconversion because of "lost art." Many of the little details of the manufacturing cycle will not appear on the specifications for jobs that ran smoothly before the war, so that there will be trouble. The operators oftentimes develop little tricks that make the difference between good and bad production. In many cases uniformly good production is the result of continuous improvement over a long period of time. Once a job is put away, this valuable experience is likely to be at least partly forgotten. Anticipating such shortcomings, the molder must re-study the fundamentals to make sure that the jobs are started after full consideration of all the hazards and variations in technique. Old operators should be reassigned to these old jobs when possible since they will help to recall the things that contribute to quality production. It is equally important to do more than turn the old job over to the old molder; a totally new study should be made by the methods engineer to make sure that the best possible technique is used. END

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For compression molding the transfer cylinder is readily cut out simply by closing a valve. The press is then ready for use in the conventional manner, with the automatic cycle control and slow-close control more important than ever because the mold closing speed is higher.

This press will be shown at the S. P. E. Exhibit, Detroit, starting Jan. 7.

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Know the Cold Molded Plastics

This miscellany—plugs, sockets, switch bases, conduit outlet covers (below) and heater connector plug, single and double flush receptacles, switch base (left)—is typical of products manufactured by the cold molding method

Good heat and electrical resistance plus economical production head merits of items made by old, well-established process

By B. F. Hantz
Chief Engineer, American Insulator Corp.

COLD molding, which has figured importantly in the development of the plastics industry since it was introduced by Emile Hemming in 1908, still maintains a significant role today because of the economical advantages it enjoys over most other molding procedures and because of the heat and electrical resistance of some types of cold molded materials. The economical advantages include the high production possible from a single-cavity mold (which reduces the cost of tooling), the rapidity with which a large quantity of a given article can be molded, and the availability of practically unlimited supplies of raw materials.

Because cold molding fills an unobtrusive niche in the plastics industry and for that reason the opportunities it offers may not always be taken advantage of, a review of the development of the process, materials and formulations, molding techniques, baking procedures, mold design, and finishing of parts is appropriate.

Before the development of cold molding, porcelain was the principal molded insulating material, being practically the only fire, heat, and waterproof material known. Shellac and rubber were also being developed, but they had their limitations.

Cold molded materials were developed and placed on the market in the period 1900-1908. Rapid strides were made in production, and serious inroads were made on the use of porcelain. That porcelain then cost only about half as much as cold molded material did not prevent these inroads. Other conquests soon followed, and cold molding became well-established.

Cold molding differs from the customary molding methods in that the parts are not completed when they come from the mold but must be baked in an oven. There they take their final form as the result of the oxidation and polymerization of the oils and binder in the compound.

(*Continued on page* 50)

Special "know how" required

FOR JOBS LIKE THIS

Letters and figures on this plastic dial (for electric refrigerator temperature control) were included in the mold. This resulted in a substantial saving over the cost of machining them into the piece, after molding.

Such a method might seem to be simple and obvious, but it required much special skill. The correct plastic compound with the proper shrinkage had to be chosen. Then, the molds had to be designed so that the pieces could be removed without defacing the markings.

This special "know-how" is what we at General Industries offer you in our molded plastics division. Of course, we have all the machinery needed for large or small jobs in compression, transfer or injection molding. But in addition, we have that ingenuity, skill in mold making and willingness and ability to think through on a job before it is undertaken. In plastics molding, there is no substitute for experience.

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The fractional horsepower motor armature shown at right was totally enclosed with phenolic compound by the Transfer molding process and is a good example of how this process can produce a nicely finished product with full protection to the electrical circuit.

The precise ruggedness required by wartime applications proved the superiority of Transfer molding, in which the compound is fully plasticized in a chamber connected with the closed mold—then flows into the mold without disturbing or distorting delicate inserts or windings. The "eye appeal" demands of peacetime competitive markets are now being similarly served.

To learn in detail the many advantages of Transfer molding, write for the literature listed below. To put these advantages to work, call in your nearest licensed Transfer molder. A list of such molders will be sent on request.

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Whatever your plastics problem, you can get the help you need from either Shaw or the Plax Corporation, 133 Walnut Street, Hartford 5, Conn. For the literature listed above, and for a list of licensed Transfer molders . . . write Shaw.

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Increasing complexity of parts demands complicated molds, which in turn call for careful and accurate mold making

The mold powder is being removed from a mixing machine after the binder and filler have been thoroughly mixed

Careful grinding and handling of molding powder are two of many factors leading to production of good finished parts

(*Continued from page* 46)

Because of these differences, cold molding must be considered as an entirely separate class of molding.

Cold molding materials are divided into three groups, depending upon their binders: (1) organic binder—bituminous—asphalt; (2) organic binder—synthetic resin—phenolic; and (3) inorganic binder—cement.

The organic type of cold molding material will withstand a higher operating temperature than most other molding powders. It is also more resistant to an electric arc, making it very suitable for electric switches and fuse plugs.

Certain classes of inorganic cold molded materials actually improve with age. They will stand an operating temperature of 1000° F. Arc chutes are an excellent example.

Cold Molded Compound—Organic Binder

Class No. 1 (organic binder—bituminous) is composed of a binder and a filler. The binder is a varnish-like material formulated from various percentages of oils, asphalts, and stearine pitch. These materials are blended and cooked in a vat, somewhat like making a varnish. This varnish is then cut with a thinner or solvent to the right viscosity, which differs with the various manufacturers. The binder is added to the filler and mixed with it in a kneading machine (Werner-Pfleiderer type mixer).

The filler is usually short or long fibre asbestos, or floats, depending upon the type of material required. The asbestos is usually purchased in Canada, as the Canadian fibre seems to give the best results. The Canadian *Crysotile* fibres are very flexible and have high tensile strength, properties which give them their great commercial importance. Sometimes, instead of asbestos, the filler is slate dust, mica, or clay.

The mixing of the binder and filler is continued until the desired properties are obtained. The powder is then spread out thinly on special trays and allowed to season for several days to make it ready for use in the molding dies.

A molding compound of Class No. 1 type might be: binder composed of stearine pitch—40 parts, asphalt—60 parts (asphalt, gilsonite), castor oil—10 parts (linseed oil, drying oil, China wood oil), benzol—25 to 100 parts; filler composed of asbestos—1100 parts, sulphur—66 parts, and iron oxide—2.2 parts.

Metal inserts can be molded into all cold molded compounds, and since the cost is not increased much, the design of parts with inserts has become customary. The inserts should be strong enough to withstand the molding pressure, and so located that they are easily withdrawn from the mold.

Synthetic Binder

In Class No. 2 (organic binder—synthetic resins—phenolic) the phenol formaldehyde resin is treated with a solvent to achieve the proper consistency before it is introduced into the mixer with the asbestos. The mixing procedure and treatment of the powder is about the same as for Class No. 1.

Molded parts made from this powder have greater mechanical strength and a better surface than those from Class No. 1. They are usually light brown or tan and can be identified by the phenolic odor given off when subjected to excessive heat. Because the binder is made from a phenolic resin, the molded parts are more expensive than those in Class No. 1, with asphalt binder.

Both organic and synthetic compounds are used to mold wiring device parts, radiator valve handles, switch bases

Most cold molding presses operate with two persons—one weighing the material, the other manipulating the press

A truck loaded with cold molded bases is being pushed into the oven for the next step in manufacture—baking

Inspection of molded parts is an important obligation of the molder often sadly neglected or completely omitted

and covers, jeep gear-shift balls, and closures for cans for blasting powder used in peace times to blow in oil wells, in war times to demolish barbed-wire entanglements. Cold molded parts are used in the home, the factory, and the office. Numerous parts are also used in lighting, power, and heating equipment.

Inorganic Binder

Class No. 3 (inorganic binder—cement) belongs to the refractory group and differs considerably from Classes No. 1 and No. 2. It is composed mostly of calcium hydrate, fine silica, and asbestos fibre. The lime and silica combine after molding by treatment under steam pressure to a silica-lime cement, the asbestos furnishing the mechanical strengthening structure. The silica-lime cements are better for plastics than the Portland cement mixtures, but they do not have the ability to stand as high temperatures.

The material is usually white or grayish in color. The moisture absorption value can be reduced by impregnating with a suitable compound such as sodium silicate (water glass). After molding, the parts are usually dried in an oven on rust-proof trays for six hours to remove moisture, treated under steam pressure for 48 hr, and then dried again.

A mixture for this material might be: asbestos, 40%; calcium hydrate (lime), 24%; silica, 30%; and water, 6%.

This compound is mixed in a regular dough mixer of Werner-Pfleiderer type for some minutes, and then placed on trays to be seasoned for some hours in the atmosphere.

This material does not mold nearly as readily as those in Class No. 1 or No. 2 because of the nature of the raw materials. The powder does not flow easily, and, in addition, care must be exercised to avoid breaking the parts while removing them from the mold. Thus, while the molding procedure is the same as for Classes No. 1 and No. 2, production is somewhat slower.

Metal inserts can be molded into parts made from this material, but they should be rust-proofed or made from brass.

This material differs from the majority of molding powders in that a molded part does not shrink after molding, or the shrinkage value is so small that it can be entirely discounted.

Molding Technique

The parts are usually produced on hydraulic rather than mechanical presses because it is necessary to have sufficient pressure in unlimited amounts available at all times. Hydraulic presses are supplied with oil or water at pressures of 2000-4000 psi. The cold molding presses range in capacity from 5 to 200 tons, which is sufficient to produce most parts required by the trade. The smaller presses, of course, operate faster than the larger ones because they use a smaller quantity of hydraulic fluid in their operation. Presses are usually supplied with oil or water under pressure from a central accumulator.

The molding cycle is very rapid. An experienced operator can produce 500 to 700 pieces per hour from a single-cavity mold. This production can be increased if a larger number of cavities are used in the mold. Of course, if it is necessary to mold metal inserts into the part, the production is reduced somewhat, depending entirely upon the number of inserts handled and the difficulty involved in inserting them in the mold.

Care must be exercised in handling the parts after they

Various kinds of knobs, heater connector plugs, weatherproof sockets, etc. can be cheaply molded in great numbers

are removed from the mold because they are still soft and fragile.

The size of the press is determined by the projected area of the piece. It is customary to apply a pressure of 2000 to 6000 psi. Experience has proved that 30% more or less pressure than normal does not affect the mechanical properties of the parts.

Baking Process

After the parts are pressed to shape, they are packed on metal trays with perforated bottoms. These allow a free circulation of air, essential for most efficient baking. They remain on the trays at room temperature for 24 to 72 hr. During this period, volatile plasticizers evaporate. If the volatiles are not allowed to evaporate, blisters form during the baking process. The trays are then put on trucks which hold from 20 to 40 trays, and the trucks are pushed into the oven. Pieces must be packed on the trays in certain ways to prevent excessive warpage or shrinkage. Sometimes clamps, weights, or shrink blocks are required to hold parts to size and shape during baking. These ovens are heated electrically with a recirculating forced draft system so that the variation in temperature does not exceed 10° F. The success of baking depends upon uniform heat and rapid circulation of the air in the oven. Much oil and volatile matter is driven off during the initial stages of baking, and if great care is not exercised, it will take fire.

The baking period varies from 8 hr to 48 hr, depending upon the size and design of the piece. A typical baking cycle is:

18 Hour Bake

1 hr— 80° C	1 hr—160° C
1 hr—100° C	2 hr—180° C
1 hr—110° C	2 hr—200° C
2 hr—120° C	2 hr—210° C
2 hr—130° C	2 hr—220° C
2 hr—150° C	

Mold Design

The molds required for the untold number of designs and shapes of articles form, without a doubt, one of the most important links in the entire chain of manufacturing processes. Because of the increased use of all plastics, the designs of parts are becoming more complicated. This, in turn, requires a greater skill in designing the necessary molds to produce them satisfactorily and economically.

It is essential that the buyer and molder cooperate as closely as possible. Only by close work and understanding of each other's problems can an efficient molding be produced in the desired quantities and at a low cost. The mold

(*Continued on page* 131)

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Lightweight, non-cumbersome nylon armor (left) and "Doron" aid in furnishing protection against shell fragments.

PLASTICS IN ARMOR

By Margarita Dobert

Nylon and glass-resin laminates helped to reduce war casualties caused by small shell fragments

CONTRARY to widespread opinion body armor did not disappear with the invention of gunpowder. Its use bobbed up intermittently throughout the years: John Paul Jones wore a corselet in his fight with the *Serapis*, the Japanese made body armor standard army equipment as late as 1870, and it was used to some extent in the Civil War and in the Franco-Prussian War. Experiments were made with armor in World War I, and probably only the close of the war prevented it from becoming important in army dress. In World War II body armor returned, stimulated originally by the need for protection of airmen against flak.

Plastics materials in the form of nylon and as laminating resins played stellar roles in the development of body armor. Other materials used either alone or in combination with one another or with plastics included steel, aluminum, and glass fabric. Programs started by different branches of the Army and Navy arrived at different kinds of armor. None of these diverse types can, without becoming too heavy for practical wear, guard against big fragments or direct hits of high explosive projectiles, but they do ward off the average small shell fragment, which is said to have caused approximately three-fourths of all casualties.

One of the leading projects on the development of armor was carried on by the Quartermaster Corps, in co-opera-

A quick pull on tie string instantly releases vest armor

Flak vest contains equivalent of 432 pairs of nylon stockings

15-ply "Doron" and the .45 caliber bullet it stopped

tion with the Naval Research Laboratories; another was sponsored by the Bureau of Aeronautics, also in co-operation with the Naval Research Laboratories; and a third was the work of Army Ordnance. The usual course of procedure was to call in plastics manufacturers for aid whenever it was needed.

The Quartermaster Corps became interested in the possibilities of plastics from a ballistics standpoint when steel became critical. The aim was at first to find a different material for civilian defense helmets. A joint Army-Navy Armor Technical Committee, headed by General Georges Doriot, was formed to co-ordinate any development work growing out of the original investigation.

In the spring of 1943, a combination of glass cloth and ethyl cellulose was found effective in stopping 45's. As a result, the program was extended, and many kinds of cloths and resins in many combinations were tried. Finally the present combination, called *Doron* after General Doriot, consisting of a special unidirectional weave glass cloth and thermosetting resin, was discovered. Thermosetting resins proved better than ethyl cellulose and other thermoplastics because of their heat and flame resistance. The kinds used were: *Laminac 4122R* (American Cyanamid), *SXRS 75* (Bakelite), *Thalid 526* (Monsanto), and *Selectron 5003* (Pittsburgh Plate Glass).

These resins were used interchangeably in combination with glass cloth. After being laid up, the resin-glass cloth laminates were cured for about 30 min under fairly low pressure (several hundred psi) at approximately 250° F. The process varied according to the equipment and the resin used. The sheets, usually made in 36″ by 36″ squares and varying thicknesses, were sawed or die cut to desired shape and sizes. The material was machined with the customary tools used for other glass cloth laminates.

Lt. Comdr. A. P. Webster of the Bureau of Medicine and Surgery calculated that 1/16″ plates of *Doron* made up of 8 layers of glass cloth would stop a .45 caliber, 230 grain bullet fired from a service automatic pistol at a velocity of 800 fps. Similar calculations suggested that a plate 0.08″ thick would stop the same bullet fired from a Reising sub-machine gun at 1150 fps. Shell fragments have a velocity of about 1500 fps when they strike, although their speed is twice that when they are fired.

Tests proved that Comdr. Webster's calculations were approximately right and that, weight for weight, *Doron* was superior to metal in guarding against hits. On the basis of these tests ⅛″, 15-ply *Doron* was recommended. This thickness weighs 1.25 lb per sq ft. To determine whether an inner padding was necessary between the armor and the body, experiments were made with the human body as the test object.

The volunteer human target was shot at 21 times. These experiments showed that when *Doron* was backed with one-inch sponge rubber or a heavy layer of kapok, the impact of the bullet resulted in no discomfort; when the backing was reduced to a single thickness of duck, severe bruises resulted, but no fracture. It was therefore decided to use *Doron* without backing, since maximum protection had to be combined with a minimum of weight.

Doron is ideally suited for armoring shipboard personnel and amphibious troops because of its low density and hence its low weight in water. The armor, weighing four pounds and covering approximately three square feet, is placed in sheath-like pockets sewn to the inside of the standard issue Marine Corps utility jacket and to the outside of the standard Navy kapok life jacket. The armor weighs only about two pounds in water and thus reduces only very slightly the efficiency of the life jacket. No straps or harness of any kind is necessary, and the garment may be put on or removed as simply as the standard issue jacket. The

(*Continued on page* 129)

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Resorcinol joints in Navy patrol boats make them strong, salt-water resistant

The Resorcinol Resins Prove Their Worth

Part 2. Directions on mixing, use, and storage; figures on output for first half of 1944; cost comparisons; and future possiblities

By Richard L. Shipley

Plastics Branch, War Production Board

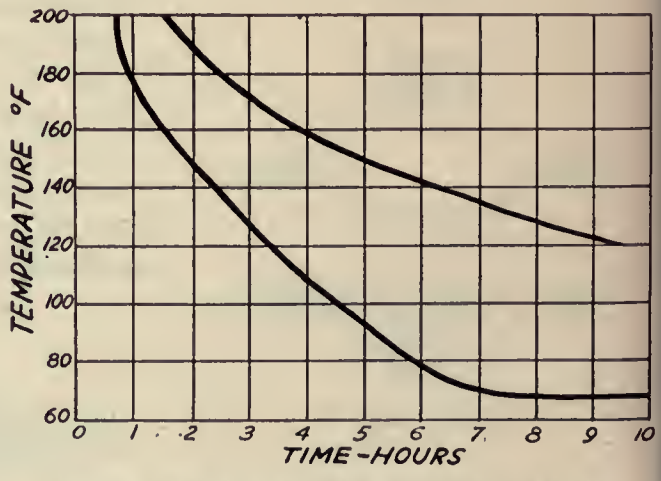
THE mixing operation for preparing the glue just prior to bonding is relatively simple and requires no particular knowledge or experience different from that required for other resin glues. Just before bonding, catalyst and resin are mixed in the proportion of about 100 parts of resin to 20 parts catalyst by weight. Thorough mixing takes about five minutes. Because the reaction between the resin and hardener is exothermic (i.e., evolves heat), it is well to use some means of cooling to prolong the pot life of the glue. The useful life of the glue decreases rapidly with small increases in temperature, so that one of the most important qualities of this resin—short curing time—is a disadvantage at this point. However, the disadvantage can be overcome by careful preparation, cooling, and use.

Efficient Handling

During the recent shortage of these resins, considerable effort was made by consumers to develop methods for efficient mixing, use, and storage. Small batches require frequent preparation, which is time-consuming and costly, whereas larger batches usually set up before being completely put to use. As the glue sets, it becomes more and more viscous and difficult to spread. However, when thickening occurs, fresh glue can be added to a mix which has not exceeded one-half of its working life. The following figures give the approximate pot life of the typical resorcinol resin glue on the market today:

Temperature	Pot Life
70° F.	4½ hr
75° F.	3½ hr
80° F.	2½ hr
90° F.	1½ hr
100° F.	½ hr

Like other glues, resorcinol glue spreads differ with the type of wood and the application to which it is put. Spreads



Minimum pressure time in heated chamber shows resorcinol (lower curve) superior to resorcinol-modified phenolic

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JANUARY is more than the first month of the new year . . . it is the cornerstone of a new era. This is the first year since long before our entry into the war that the world starts off a New Year at peace.

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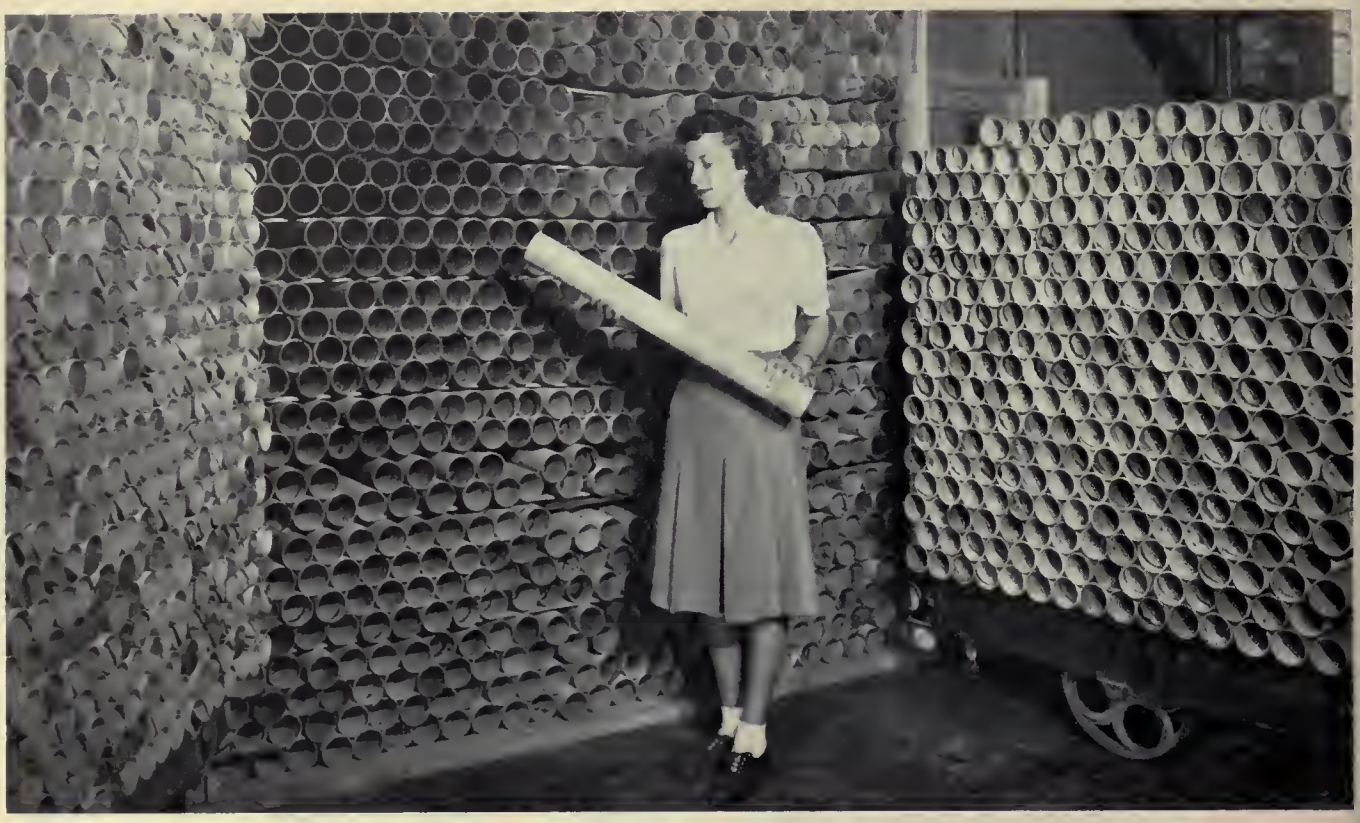

Spirally made wooden tubes glued with resorcinol are used on Navy float cables to help explode magnetic mines

using only 30 lb of glue mix per thousand feet can be used, whereas spreads using as much as 70 lb per thousand are necessary for some applications. Thicker spreads can be used with resorcinol glues than with most others because of their non-crazing characteristics. This makes them especially valuable in joint work and lamination of heavy pieces.

Although resorcinol resins can set at room temperature, slightly higher temperatures can be used to accelerate the cure if production schedules demand it. All manufacturers appear to agree that 70° F is the lowest temperature limit, but schedules have been worked out showing time-temperature relationships to as high as 200°. Such high temperatures, however, would be justified only by reason of some particular problem, inasmuch as there are obtainable on the market resorcinol-modified phenolic resins which can be used at slightly elevated temperatures at a cost which is much less than that of resorcinol resins.

The table below gives a comparison of the relative pressure periods at various temperatures for a straight resorcinol resin and a resorcinol-modified phenolic resin.

Pressure Periods at Various Temperatures

Temperature (°F)	Resorcinol Resin (hr)	Resorcinol-Phenolic Resin (hr)
70	10.0	
80	6.0	
100	4.75	
120	3.5	10.0
140	2.5	6.5
160	1.75	4.0
200	0.75	1.5

Since the annual production of other adhesives runs into

Variety of end joints is used in building ship timbers

Low temperature setting resorcinols speed boat production

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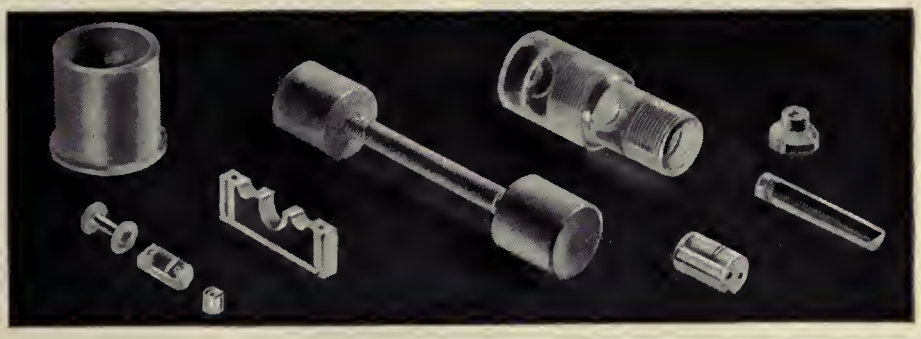

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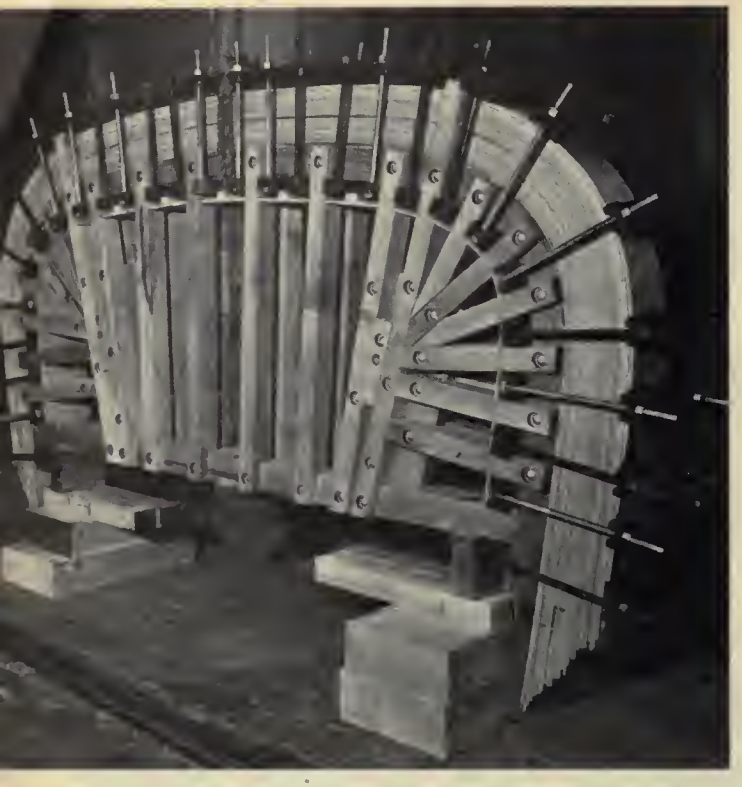


Good adhesives play part in obtaining extreme curvatures

millions of pounds each, resorcinol resins at their present rate of production would appear to be rather insignificant. As has been mentioned, however, these materials have just broken into the field, and it is not at all impossible that considerably larger production may be expected in the near future.

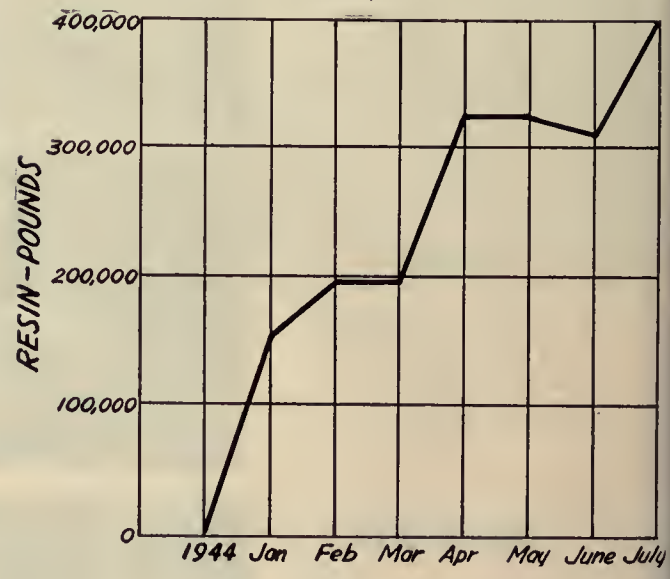
Not counting resorcinol-modified types of resins of low percentage resorcinol content and considering only the standard product, production and use of this material was practically nil in 1944. Not until 1945 was it used to any great extent, and then the demand was an overnight one brought about by military requests.

Cost and Future

The future of resorcinol resins and adhesives appears to be assured. There is no doubt that they present the qualities required by wood-working adhesives, such as moisture resistance, tensile strength, and heat and ageing characteristics. In addition to these properties the ability to set at room temperature and at an exceedingly rapid rate at higher temperatures is also extremely desirable. Minor disturbances such as the short pot life undoubtedly will be overcome by the ingenuity of the industry. Probably the greatest deterrent to their complete acceptance is their high cost. If predictions come true, however, this disadvantage will soon be overcome, since it is expected that a price which will meet the other adhesives now on the market will be attained. The bases for this assumption are that, first, with the gradual increase in production its price will fall; and, second, the effective concentration of resorcinol in the finished adhesive will be so reduced through improvements in compounding that the cost will come within the reach of all superior end-products. In fact, before this paper is printed, the price of resorcinol resin adhesives may have taken a considerable plunge.

Balsa float body reveals quite intricate laminations

The current price of phenol is 10½ cents per pound and resorcinol about 64 cents per pound. Thus, if resorcinol resins are to compete with the phenolic resins purely on the basis of price, resorcinol costs must drop substantially. The following table of comparative costs suggests the large reduction which will be necessary if resorcinol resin glues are ever to be an important factor in the adhesive industry:



Resorcinol resin glue	55¢
Resorcinol-modified phenolic	34¢
Phenolic resin glue	23¢
Urea formaldehyde	17½¢
Casein glue	12¢ to 20¢
Animal glue	12¢ to 21¢

Cost of Mixture

Actually, a fairer comparison is to be had by indicating the cost of the glue mixture per pound, including the solvents and fillers incorporated into the mix by the user. On this basis the relative costs would be as follows:

Resorcinol resin glue	49¢ per pound
Resorcinol-modified phenolic	23¢ per pound
Phenolic resin glue	15¢ per pound
Urea resin glue	6¢ per pound
Casein glue	6¢ per pound
Animal glue (hide)	6¢ per pound

END

This is the second and final installment of the article, the first having appeared in the December, 1945, issue. Pictures of the laminating jigs and the balsa float body are official U. S. Navy photographs.

Knife Guide Stripper Body Molded for x-acto CRESCENT PRODUCTS CO., New York, N. Y.

Model Examples of Carefully Controlled Molding

Except for slight coring, the bodies of both of these model makers' tools are solid, chunky blocks of injection-molded, hard-surfaced, highly rigid polystyrene.

From the design angle, the plastic reproduction of the pieces presented no particular problem—but, from the material angle, and due to the thickness equation, the approach called for the tops in technique . . . "If you knew Poly, like we know Poly"—you'd appreciate the difficulties.

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COMPRESSION molding
TRANSFER molding
INJECTION molding

Plastics at Work

Built-in moisture control" is featured in this flexible, compact tobacco pouch fabricated of vinyl chloride-acetate by the Clarvan Corp. The low moisture vapor transmission rate of the material, plus the small "Humi-Pod" blotter within the pouch, combine to keep contents fresh and moist at all times

Combination of the decorative and utilitarian possibilities of plastics are advantageously exemplified in dressing table accessories such as this acrylic "vanity set"; the unique three-way mirror may be held in the hand, used with handle placed around neck to leave both hands free, or set on table to reflect from angle

Underside grooving catches and reflects lights in this sparkling star-shaped package of clear white polystyrene, holding a "Star" Sapphire phonograph needle fastened to a cushion of sapphire blue

A bright touch for "blue Mondays" is indicated in these gaily-colored clothespins, which are composed of two phenol formaldehyde parts, cast in a phenolic mold, and joined by a metal spring

Holes cut through the cross-shaped section in the raised platform-like center part of these acrylic buttons make it possible for them to be sewn flat to garments. Duplex Plastic Products Co. makes them in clear and in red colors

Fashioned to fit tiny fingers, miniature furniture of featherweight "Lumarith" in various shades, provides dainty yet sturdy toys of absorbing interest, while smoothly finished edges, color-fast qualities, and easy cleanability supply the practical aspect

What Paper for Laminates?

By Robert W. Barber

Ass't Plant Manager, Panelyte Div., St. Regis Paper Co.

Fiber direction, paper thickness, density, and other characteristics determine properties of end products

SO IMPORTANT is the choice of paper for laminate reinforcement that the success or failure of the product in a given use may hinge upon whether the proper type was selected. Since this is true, it is well for the fabricator to know how, and to what extent varying the thickness, fiber orientation, other characteristics of paper structure, grade and type of pulp, etc., will affect the properties of the finished laminate.

A paper-plastics laminate combines the properties of the two components in much the same way that steel and concrete in reinforced concrete support each other. The resin, high in compressive strength but low in tensile, occupies the free space between the fibers of the base material and thus bonds the fibers in adjacent layers to consolidate the individual plies into a solid unit. In so doing, the resin imparts to the laminate its high compressive strength and seals and protects the fibers of the base material, which, in turn, contribute the major portion of the composite tensile strength.

To obtain the maximum theoretical tensile strength of the cellulose fibers, all should lay in the direction of the loading and be free of curl or twist, so that all are uniformly loaded. This condition, obviously, cannot be even approximated in a sheet of paper. An approach is made toward this end, however, by making the sheet quite thin and as directional as possible. By following this procedure, the fibers tend to lie flatter, with most of them in a parallel plane. A balanced strength in two directions can be attained by laying alternate sheets 90° to each other.

The effect of the construction of the paper on the strength of the laminate can be seen by an examination of Table I, which makes direct comparison between two papers with the same furnish. Laminate 1 is made of a thin directional paper, Laminate 2 of a thicker sheet somewhat less directional. The two factors which cause this difference in strength cannot be isolated—that is, the directional properties of the sheet on the one hand and its thickness on the other. There is good reason to believe, however, that both affect the tensile properties.

Ground wood and other non-chemically treated pulps are too weak and are generally unsatisfactory as reinforcing agents in laminates.

The types of papers in common use are: sulphite (particularly Mitscherlich sulphite), sulphate Kraft, Alpha, and rag stocks. The tensile strength figures in Table II show that these types decrease in strength in the order named,

Double lid for home freeze unit or ice-cream cabinet, made from paper-based "Panelyte," has the needed insulating value, stability of form, toughness, strength

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Inside of refrigerator door. Breaker strip made of paper-based laminates offer effective barriers to heat and cold

although there is little difference between the rag and the Alpha stocks. Not all papers used in this study were designed to obtain the maximum strength for the particular type of pulp in question. It is, therefore, not possible to isolate the effect of the structure of the paper from that of the particular pulp used in its manufacture. Nevertheless, the fairly definite conclusion can be drawn that the type of pulp used is much less a cause of strength differences than the mechanical structure of the paper itself.

The tensile modulus bears an almost direct relationship to the tensile strength. The compressive strength also is higher with the less refined pulps—the thin Mitscherlich sheet being the highest. In compression, however, the differences are much smaller, as expected, because compressive strength is largely supplied by the resin. The flexural strength follows the same trend as the tensile and compressive strengths, and, also as expected, the differences in values for the various types are less than for tensile and greater than for compressive strength.

The variations exhibited in the impact strength figures, particularly the pronounced differences between the flat and edge values, are of interest. Paper laminates are somewhat low in impact strength when their position in the general group of reinforced plastics is considered. The ability to absorb the energy of an impact is greater in a structure that is not too homogeneous, and is further increased by a composition consisting of plies which are predominantly fibrous and which are bound together with resin. This explanation accounts for the large differences between the flat and edge impact strengths and also for the marked differences between the values for paper and cloth.

The bonding strength is appreciably higher when thicker paper is used, and markedly increased by the use of the softer, more absorbent, papers. The difference is partly a function of the greater amount of fiber interlock obtained when the softer papers are laminated, but also is undoubtedly affected by the lay of the fibers. The thicker sheets have a greater proportion of fibers outside the plane of the laminae and therefore contribute to some degree to the tensile strength in the direction of the thickness of the sheet. Aside from these considerations, the thickness of the sheet might be expected to have some bearing in itself, although experiments have not shown that laminates using papers of 20-30 mils thickness (test figures not shown herein) are much better bonded than laminates using 10 mil paper.

The shear strength is apparently not greatly affected by either the type of pulp used or the physical structure of the paper.

Resistance to Moisture

The water absorption is lower when a more highly refined furnish is used, and is also somewhat better with a softer sheet. Obtaining good water resistance is purely a matter of protecting and sealing off the cellulose fibers, as the phenolic resin is practically unaffected by water. It follows that the more highly refined the fibers are and the more open the sheet, the more accessible are the fibers to the protecting resin. This fact largely accounts for the extended use of highly refined pulps in electrical applications, as the maintenance of electrical qualities under varying humidity is of equal importance to the initial electrical properties themselves.

In comparing the properties of the fabric-base laminate used in the test (see Table II) with those of the paper-base laminates, the former is seen to excel only in impact and bonding strength. The other strength characteristics are lower for fabric base than for the paper materials, which are not considered as high strength laminates.

Certain limitations exist which must be considered in applying paper laminates. The tendency to creep or cold flow at high loadings, although considerably less with laminates than with other plastics, appears at lower stresses for paper laminates than for some metals. Also, the operating conditions, particularly temperature and humidity, to which the paper laminate will be exposed, must be considered, since high temperatures will result in a slight deterioration, and high humidities, despite the excellent moisture resistance, do result in slight dimensional changes.

Paper laminates are put to many and varied uses. Radio coils are wound on paper laminates. Terminal strips, switch mountings, socket bases, insulating brackets, and many other radio parts are made of paper base laminates. In most refrigerators, the breaker strips in the door frame are of paper laminates, as is the whole inside of the door itself, the insulating parts of the switches, and several parts of the compressor. Many automobile ignition systems are

(*Continued on page 86*)

Table I. Effect of Construction of Paper on Strength of Laminate

Paper characteristics	Laminate 1	Laminate 2
Furnish	Sulphate	Sulphate
Basis wgt (24" by 36" by 480) lb	34	93.0
Thickness (mils)	3.5	11.0
Density (lb/mil)	9.7	8.4
Oil penetration (sec)	3.5	6.0
Gurley densometer (sec/100 cc)	7.5	7.5
Type of Resin	Phenolic	Phenolic
Physical Properties		
Tensile strength (psi)	23,500	21,000
Modulus of elasticity	2.2×10^6	2×10^6
Flexural strength (psi)	30,000	28,500

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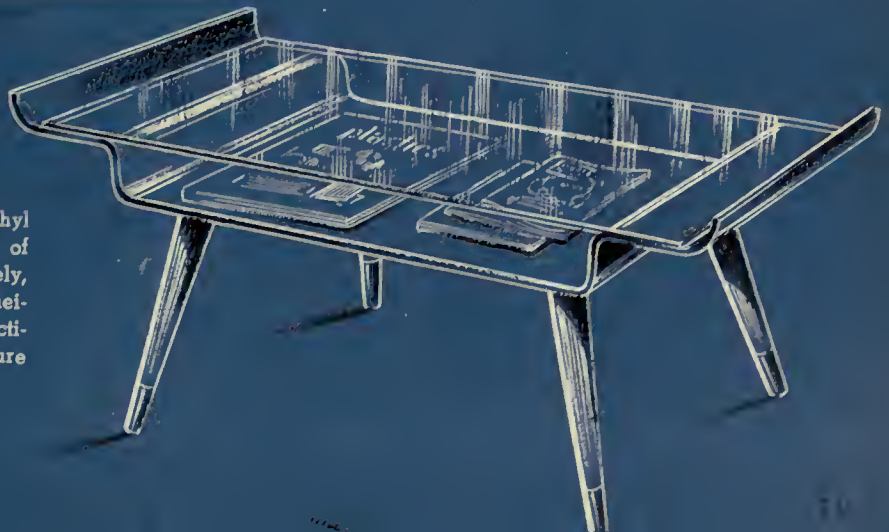
Drawings by Julian Krupa, *plastics* Art Staff

A Presentation of the Potential Applications of Plastics as Visualized by Industrial Designers

(*plastics* welcomes designers' contributions to this department)

An all-plastics Glamor Kit to delight the feminine heart is designed by Julian Krupa. "Kimpreg" or "Formica" in a choice of lovely colors make an attractive, durable, scuff-resistant case. The inside is fitted with a wide selection of beauty aids. These fit in grooves, so that top is flush. Fluorescent lights behind mirror are connected by a cord which automatically springs back into case when not in use. Ornamental handle is of acrylic



Lionel C. Algoren adds top and ferrules of methyl methacrylate to a gracefully formed panel of resin-bonded plywood, in the design of a lovely, modern cocktail table. The alcohol-proof synthetic lacquer finish of the plywood makes it a practical as well as a decorative piece of furniture

Use of inserts involves many problems, such as wall thicknesses needed, variations in expansion, relief of stresses

INSERTS Their Design, Selection and Use

A compilation of instruction and data of help to designers and molders

NOMENCLATURE

Through-type:	Insert is exposed on both sides of material
Open-hole:	Hole is drilled through insert
Blind-hole:	Hole is not drilled entirely through
Blind-hole, partial thread:	Thread is counterbored from front for terminal or other assembly fit
Protruding type:	Part of insert protrudes from molded material
Eyelet type:	Part that protrudes from material is used for spinning over in assembly
Rivet type:	Part that protrudes from material is riveted in assembly
Usual type:	Inserts common to plastics industry
Anchorage:	Part of insert molded inside plastics and held fast by shrinkage of plastics
Retaining pin:	Pin on which insert is placed and located prior to molding
Floating of insert:	When pressure is applied on mold and material softens, it flows upward. If insert is loose on retaining pin, some material flows under insert or into anchorage points and carries or flows insert off retaining pin
Crushing of insert:	When protruding insert is molded in conventional mold without any protection, it will be crushed or collapsed by material which flows into hole provided for protruded part in upper part of mold
Flow of material into insert:	If threaded open-hole insert is being molded, retaining pin does not prevent material from flowing into insert unless retaining pin is threaded, which would increase cost of molding
Sealing diameter:	Diameter of insert which is free of knurl and is allowed to enter mold to prevent flow of material

THE importance of inserts in good design is just as important as the overall design, for should weaknesses develop in the insert, the finished part itself would undoubtedly fail to meet the demands for which it was produced.

Therefore, it is vital that the molder be thoroughly familiar with the many steps involved in insert design. More vital is his knowledge of the problems he will encounter, and his ability to cope with them adequately.

Prepared by SPI

As noted in ***plastics*** previously (see *"Insert Design,"* June, 1945) this experience and knowledge should be possessed by the product designer as well as the molder. Only in this manner, it is pointed out, can maximum strength of product be coupled with minimum cost of molding. Therefore, the excellent compilation just completed on insert design for the second chapter of SPI's Handbook* takes on great significance, and it is presented here in abridged form for the basic information it conveys to those who are concerned with the design, selection and application of inserts.

Although the conventional screw-machine type round insert is common, numerous designs are used, as illustrated in Fig. 1.

* A full copy of the original text, with complete drawings, may be obtained from SPI.

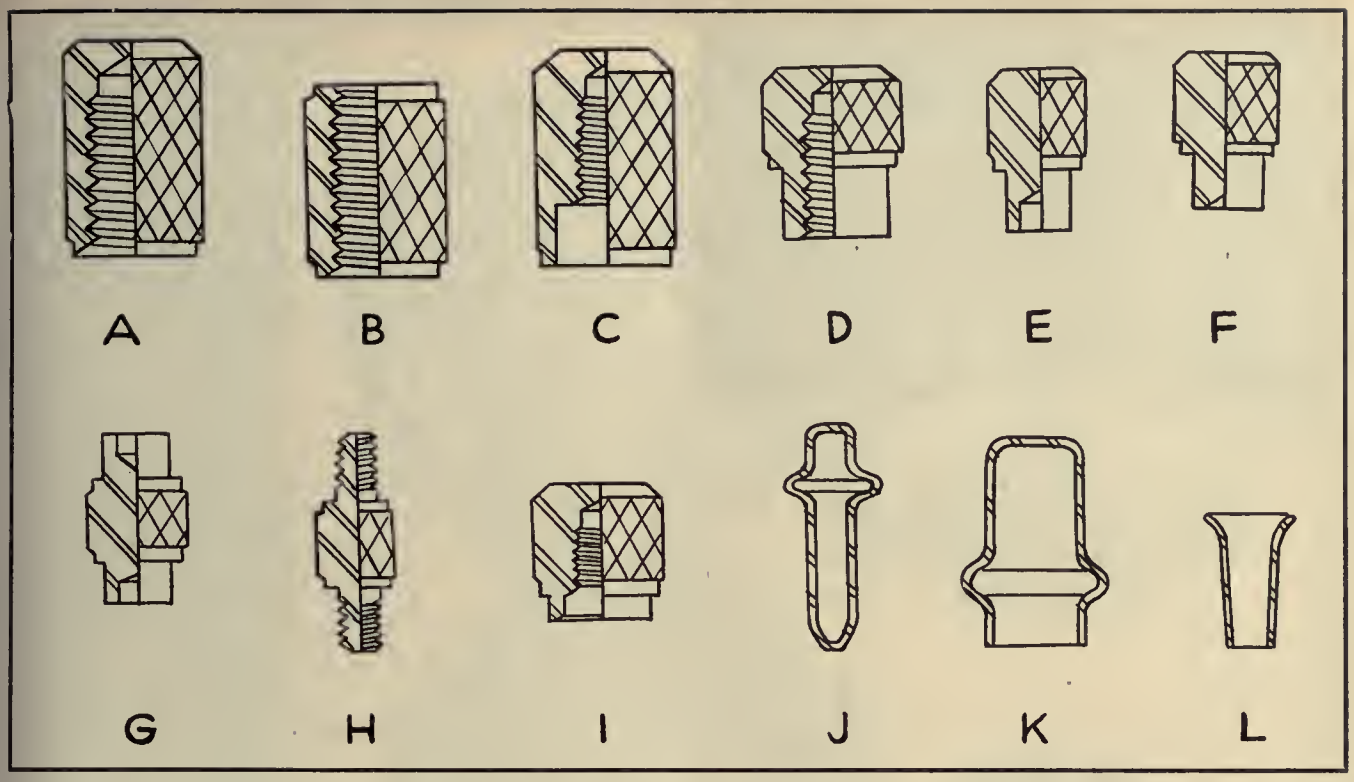


Fig. 1. Numerous designs of inserts are used besides the conventional screw-machine type round insert. Shown are the following types: (A) blind hole, (B) open hole, (C) blind hole counterbored, (D) blind hole protruding, (E) eyelet protruding, (F) eyelet both ends protruding, (G) protruding rivet, (H) double protruding with threads, (I) protruding eyelet with internal threads, (J) drawn pin, (K) drawn shell, and (L) drawn eyelet

Dimensions and tolerances for the usual type of male and female inserts are shown in Fig. 2 and Table 1.[1] These inserts are practicable for machining as a single operation on an automatic screw machine and hence are economical. The dimensions for tapped inserts apply only to non-ferrous metals where the depth of usable tapping is not more than 1½ times the tap diameter. On A-2 (minor diameter) and C (length of tapped inserts) the maximum "Standard" tolerance should be specified whenever possible. For closer tolerances, however, "Precision" can be specified. To maintain the "Precision" tolerance, reaming and other operations are necessary—at additional cost. If steel inserts are desired, Fig. 2 and Table 1 cannot be used in design without modifications, resulting in higher cost than if brass or, in special cases, aluminum is used.

Anchorage

Inserts must be anchored sufficiently to prevent turning under torque and pulling out under tension. Since there is no chemical or natural adherence between plastics and metal inserts, anchorage must be obtained by mechanical means which keep internal stresses in the molded part at a minimum. The slight anchorage obtained by the shrinkage of plastics around the insert is never sufficient.

Recommended means of securing anchorage and minimizing possible cracking around the insert is, in almost all instances, to use round stock diamond knurled. Knurling is best accomplished in screw machines with "end" tools. The stock sizes given in Table 1 are ample to allow end knurling and to leave sufficient stock for a proper "sealing" diameter free of knurling at the open end of the insert. If grooving is used with a diamond knurl, one wide groove should be used in the center of the insert rather than two grooves, one on each end. The center groove allows the material to shrink or creep toward the center, resulting in minimum strain and least danger of cracking.

It is mechanically incorrect except in specific applications to use hexagonal stock because it provides torsional anchorage only. Whether round or hexagonal stock is used, sharp corners—which set up internal stresses leading to cracking—must be avoided. Right and wrong designs are illustrated in Fig. 3.

[1] Compiled in co-operation with the National Screw Machine Products Association.

"DON'TS" IN INSERT DESIGN

DON'T Use inserts if they can be avoidad
" Mold through-type insart unless mold is dasigned for it
" Use open-hole insart if it can be avoidad
" Leave sharp corners on insarts. Chamfer where possible
" Try to mold insarts without proper anchorage
" Flatten insart if it is loosa on retaining pin
" Put matarial into insert to hold it on retaining pin; instead, ra-tap
" Usa dirty inserts
" Use drawn-type eyelets unless necassary
" Allow too thin a wall of plastics on back of insert (A thin wall will bulge up and appaar like blister caused by undercure)
" Allow too thin a wall of plastics around insert, bacause plastics will crack
" Design part or insert until correct plastic has baan selected for application
" Carry knurl out to edga of insert
" Try to mold long inserts by supporting one and only
" Mold large insert either thermosetting or thermoplastic materials without heating it bafore molding
" Make rataining pin too larga or hole for male insart too tight; this will result in inserts pulling out of matarial
" Usa standard nuts and scraws

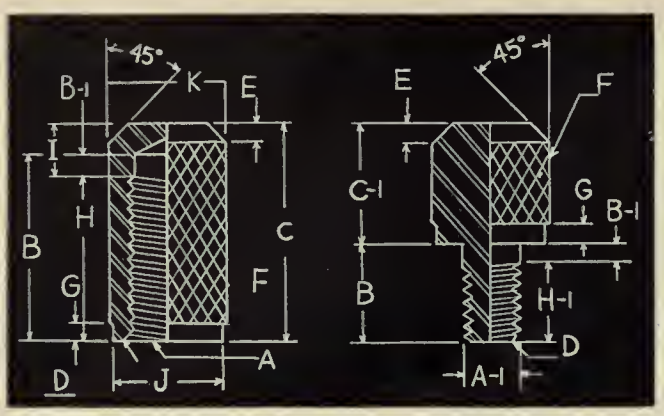


Fig. 2. Dimensions and tolerances are shown for usual type of male and female inserts. Legend: (A) tap size "American National" Class 2; (A-1) major diameter; (A-2) minor diameter—"regular" tolerance + 0.0025", "precision" tolerance—0.0005"; (B) depth of minor diameter; (B-1) number of unusable thread from bottom (cut thread); (C) length—"regular" tolerance ± 0.010", "precision" tolerance ± 0.001"; (C-1) length of body male insert ± 0.010"; (D) thread chamfer 45° ± 0.005"; (E) body chamfer 45° ± 0.010"; (F) knurl; (G) sealing diameter length, min. 1/32"; (H) length of usable thread, 1½ × diameter; (H-1) length of usable thread, H-1 + B-1 = B; (I) amount to add to H to get C (H + I = C); (J) sealing diameter ± 0.002"; (K) minimum bar stock diameter

The molder must consider the thicknesses of the walls of the insert itself and of the wall of material around the insert. The walls of an insert must be thick enough not to be collapsed by shrinkage of the plastics and by molding pressure. Otherwise, the diameter may be decreased out of the range of specified tolerances. Table 2 shows the minimum recommended diameters of bar stock for various sizes of inserts.

The thickness of the wall around inserts depends upon: (1) whether the material is thermoplastic or thermosetting, (2) type of material within each group, (3) shrinkage of material, (4) modulus of elasticity, (5) coefficient of expansion of the material, (6) coefficient of expansion of the metal, (7) temperature range over which the molded part will function, (8) moisture sensitivity, (9) loss of flexibility caused by ageing, (10) ability of the material to cold flow after curing so that it can stretch slightly without cracking, and (11) the design of the insert. Table 2 shows recommended minimum wall thicknesses for various plastics when used with plain round inserts.

Torque and Tension Testing

Tests for torque and tension testing should be simple and inexpensive, as shown in Fig. 4. In the torque test, a line can be scribed on the surface of the insert and plastics so that the slightest possible turn can be detected. To eliminate friction, screws specially hardened and ground are essential. They should be well lubricated before the test is made. A standard graduated torque wrench is recommended. Test results are indicated in inch-pounds torque.

Problems in molding common types of inserts will be taken up in the following paragraphs, the head of each section indicating the nature of the problem.

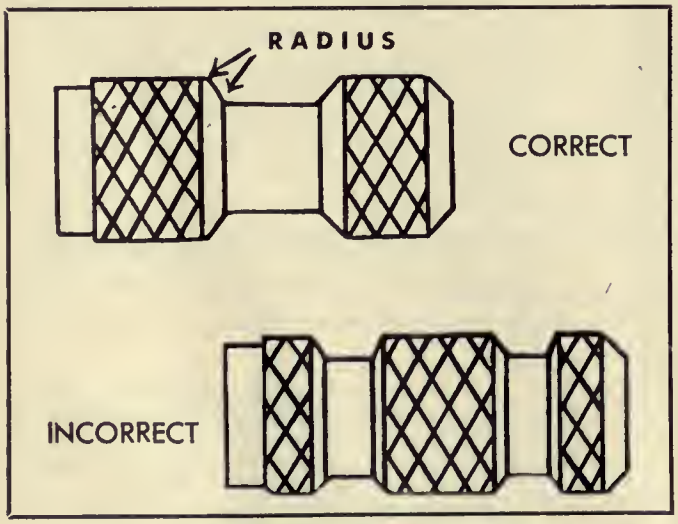


Fig. 3. Correct, incorrect designs. Correct design avoids sharp corners, which set up internal stresses

FLOATING: Floating of inserts can be controlled or prevented by several methods, among them (1) tapering the retaining pins slightly, starting the taper at the fillet and carrying it up to 1/3 of the length of the pin. In most cases, 0.003" taper is enough, provided that the maximum tolerances of the minor diameter are maintained. If too much taper is allowed for drive fit, the insert may pull out of the material. On male inserts a taper hole can be provided for a drive fit if close accuracy of inserts is maintained (0.0005 to 0.001"). If the insert is long enough, a small side hole can be drilled in the pin and music wire inserted to provide spring action. This spring action prevents the insert from floating in practically all methods of molding. The same method can be used for holding inserts in the top half of the mold. When an even more precise location of the insert is desirable, removable threaded pins are provided in the mold, to which inserts are screwed. However, this procedure increases the cost of production.

Other satisfactory methods are (2) using a straight knurl on the retaining pin to provide sufficient holding surface, (3) using a square retaining pin, (4) using an extended shoulder on the insert—shown in Fig. 2 as J (sealing)—which is allowed to enter the mold proper (not a permissible method, however, when inserts must be flush with the surface of the material), and (5) using spring tension pins in which the retaining pin is slotted and music wire inserted into the slot (the slightest flow of material into the slot, however, prevents the spring from functioning properly).

Split pins are practical on blind-hole inserts.

CRUSHING OF INSERTS: Maintenance of close tolerances on insert length practically eliminates difficulties with crushing in transfer molding. In compression molding when the insert must show on both sides and is molded vertically or in line with the press motion, crushing of inserts can be prevented by the use of preforms with holes to allow the preform to slip over the insert. Sliding pins are provided in the force plug, operated by spring, air, or hydraulic action. These pins are in a down position when the mold is being closed, and they contact the surface of the inserts before the flow of material takes place. Since the pins are under constant pressure, no material can enter the insert. This method can be applied to blind or open hole inserts, and either top or bottom pins. Considerable pressure can be applied on the inserts. Actual tests on a brass insert ½" long, 6 by 32 thread, with 1/16" wall, show that the insert withstands 6 cycles of 500 lb total pressure with a reduction of 0.0005" in length. When the inserts are not of the through type but are close to the rear surface of the molded part, pre-heating of material and insert is recommended.

PROTRUDING INSERTS: Whether the protruding section is

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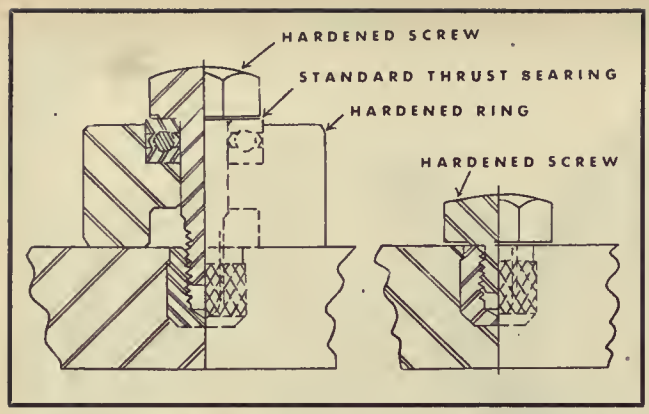


Fig. 4. Tests should be simple and inexpensive, like tension (left) and torsion. Hardened screws eliminate friction

used for assembly or for bearing points, good anchorage is essential. In special cases, especially on large inserts where the molded part is subjected to considerable torque, it is advisable, to obtain a tight connection, to allow a hexagonal section of the insert to protrude above the molded surface for a wrench grip. Thus, strain is applied on the insert rather than on the plastics. Where a limited wall of material must be used, the anchorage section of the insert should be turned and coarse diamond-knurled.

Flow of Material Into Open-Hole, Through-Type Inserts: In transfer molding, insert length should be maintained from 0.001″ to 0.002″ oversize. When the mold is closed, the insert is pinched in the mold and material cannot enter. In compression molding, however, pressure type pins should be used to prevent material from entering the hole. Without pressure pins, it is advisable, especially on larger inserts, to tap the inserts undersize before molding and retap to proper size after molding. Extreme care should be taken in retapping not to strip threads, especially if considerable material has flowed in. On small inserts it is most economical to mold the insert with a drilled hole and to tap after molding.

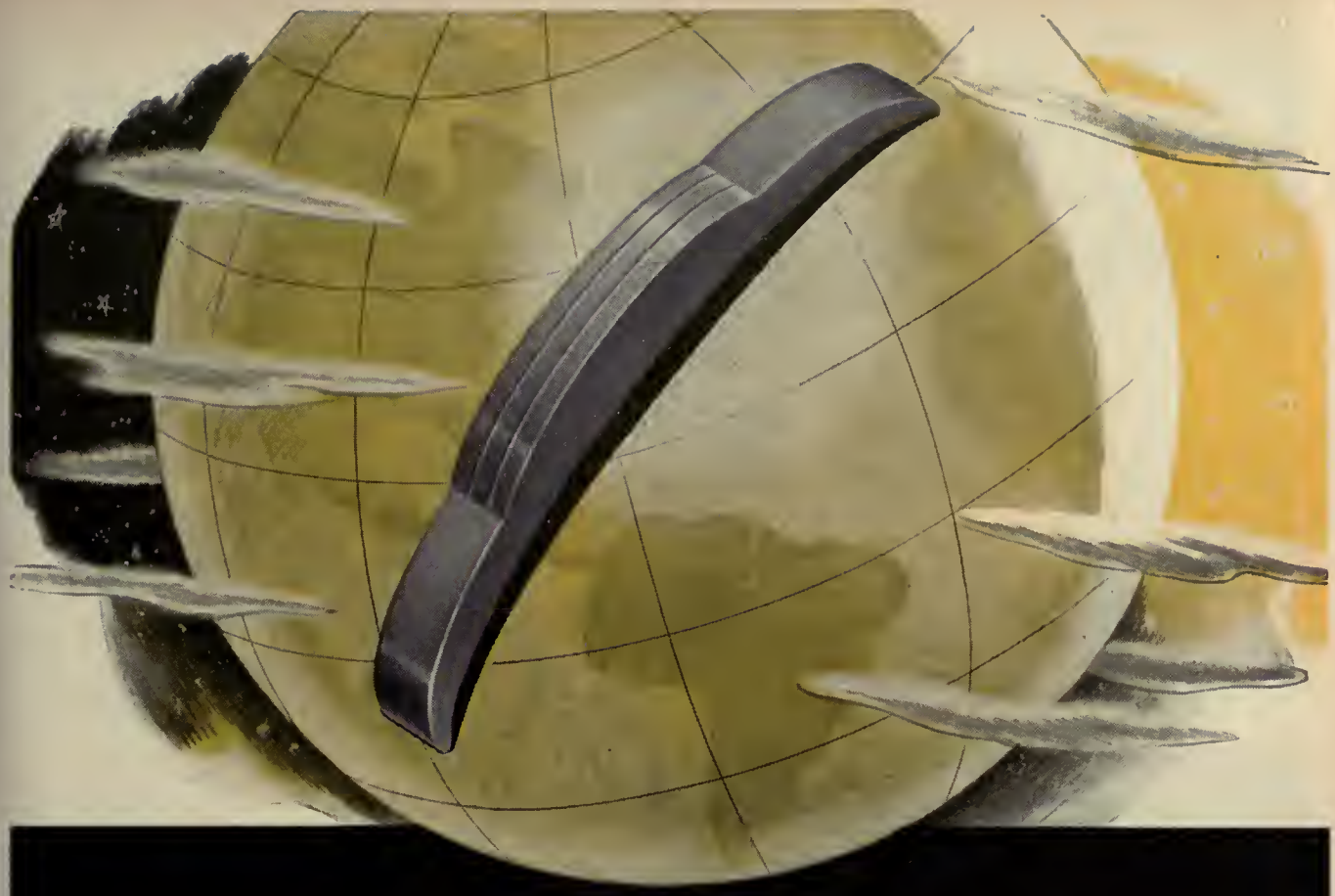
Flow of Material Into Blind-Hole Inserts: Flow into blind-hole inserts, not so much a problem as with the open-hole types, is in most cases caused by loose retaining pins, which allow the insert to float with the flow of material; uneven machining on the face of the insert; or knurling on the entire outside diameter of the insert, leaving extended burrs on the face which do not permit the insert to rest flat on the surface of the mold or the surface of the retaining pin. In all cases, it is good practice to provide a slight recess in the mold, accommodating the outside diameter of the insert. When the J diameter (Fig. 2) of the retaining pin is the same as that of the insert and sharp corners can be retained in the hole, 0.005″ depth is sufficient to prevent the plastics from flowing in. This method allows the surface of the insert to protrude above the surface of the molded part, which is desirable, especially when electrical contacts are made.

Cold-Forged Inserts

No specific formulas exist for controlling the individual relationships of the diameters and widths of collars to the shank or for controlling the kind and variety of shapes, like ribbed, finned, pinchneck, hexagon, and so on, which may be combined with other symmetrical or unsymmetrical shapes in one piece. For each problem, therefore, the de-

Table 1. Non-Ferrous Inserts Which Have a Usable Thread Length Not More Than 1½ Times the Tap Diameter

Tope Size "American Notional" Class 2		Minimum Bar Stock Diameter	Sealing Diam. (±.002″)	Top Drill	Minor Diameter Regular Tolerance: .0025″ Precision Tolerance: .0005″	Major Diameter		Number of Usable Threads from Bottom (Cut Thread)	Length Minus Length of Usable Thread 1½ Times Diam.	Thread Chamfer (45°, ±.005″) and Body Chamfer (45°, ±.010″)	Knurl
Coarse	Fine					Max.	Min.				
2-56		3/16	9/64	No. 50	0.0700	0.0860	0.0820	3.0	3/32	1/64	Fine
	2-64	3/16	9/64	No. 49	0.0730	0.0860	0.0822	3.0	3/32	1/64	"
3-48		7/32	5/32	No. 45	0.0820	0.0990	0.0946	3.0	7/64	1/64	"
	3-56	7/32	5/32	No. 45	0.0820	0.0990	0.0950	3.0	3/32	1/64	"
4-40		7/32	11/64	No. 43	0.0890	0.1120	0.1072	2½	7/64	1/64	"
	4-48	7/32	11/64	No. 42	0.0935	0.1120	0.1076	2½	7/64	1/64	"
5-40		1/4	5/16	No. 37	0.1040	0.1250	0.1202	2½	7/64	1/32	Medium
	5-44	1/4	5/16	No. 37	0.1040	0.1250	0.1204	2½	7/64	1/32	"
6-32		1/4	13/64	No. 33	0.1130	0.1380	0.1326	2½	5/32	1/32	"
	6-40	1/4	13/64	No. 32	0.1160	0.1380	0.1332	2½	9/64	1/32	"
8-32		9/32	7/32	No. 29	0.1360	0.1640	0.1586	2½	5/32	1/32	"
	8-36	9/32	7/32	No. 28	0.1405	0.1640	0.1590	2½	9/64	1/32	"
10-24		5/16	1/4	No. 23	0.1540	0.1900	0.1834	2½	3/16	1/32	"
	10-32	5/16	1/4	No. 20	0.1610	0.1900	0.1846	2½	5/32	1/32	"
12-24		3/8	5/16	No. 16	0.1770	0.2160	0.2094	2½	13/64	3/64	"
	12-28	3/8	5/16	No. 13	0.1850	0.2160	0.2098	2½	11/64	3/64	"
1/4-20		13/32	11/32	No. 6	0.2040	0.2500	0.2428	2.0	13/64	3/64	Coarse
	1/4-28	13/32	11/32	7/32	0.2187	0.2500	0.2438	2.0	11/64	3/64	"
5/16-18		15/32	13/32	G	0.2610	0.3125	0.3043	2.0	7/32	3/64	"
	5/16-24	15/32	13/32	I	0.2720	0.3125	0.3059	2.0	13/64	3/64	"
3/8-16		9/16	15/32	O	0.3160	0.3750	0.3660	2.0	1/4	3/64	"
	3/8-24	9/16	15/32	Q	0.3320	0.3750	0.3684	2.0	7/32	3/64	"
7/16-14		5/8	17/32	U	0.3680	0.4375	0.4277	2.0	9/32	3/64	"
	7/16-20	5/8	17/32	25/64	0.3906	0.4375	0.4303	2.0	1/4	3/64	"
1/2-13		11/16	19/32	27/64	0.4218	0.5000	0.4896	2.0	5/16	1/16	"
	1/2-20	11/16	19/32	29/64	0.4531	0.5000	0.4928	2.0	17/64	1/16	"
9/16-12		3/4	21/32	31/64	0.4843	0.5625	0.5513	2.0	11/32	1/16	"
	9/16-18	3/4	21/32	33/64	0.5156	0.5625	0.5543	2.0	9/32	1/16	"
5/8-11		13/16	23/32	35/64	0.5469	0.6250	0.6132	2.0	3/8	1/16	"
	5/8-18	13/16	23/32	37/64	0.5781	0.6250	0.6168	2.0	5/16	1/16	"



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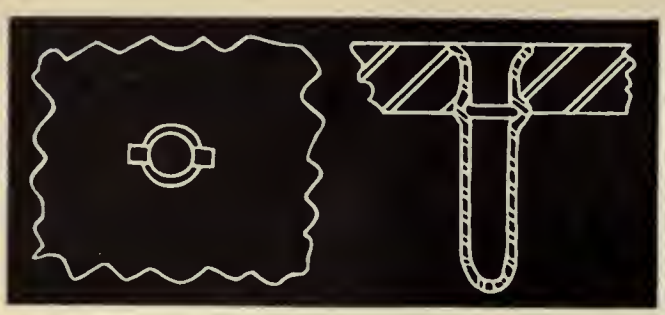

Fig. 5. Drawn-type pin with open end. Two segments are sheared and folded during molding for partial anchorage

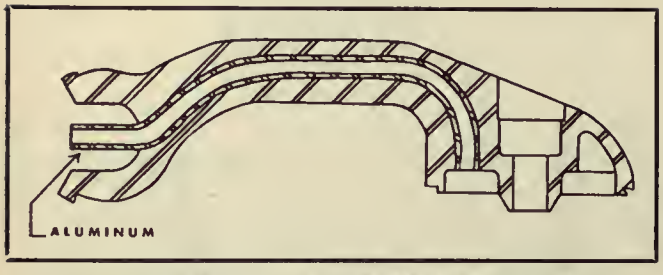

Fig. 6. Danger of cracking is less when intricate inserts are of aluminum, which "gives" as plastics shrinks

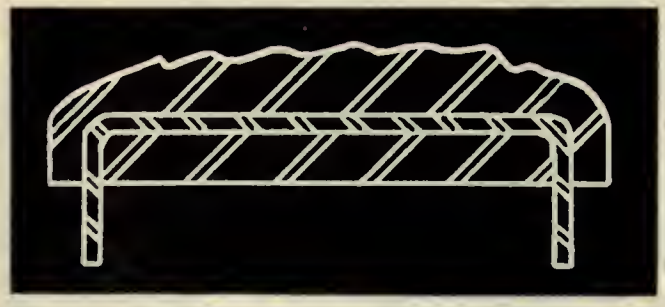

Fig. 7. U-shaped inserts are troublesome, and in the long run it is advisable to use two separate inserts

signer of the molded piece and the manufacturer of the insert must cooperate to reach a solution.

In general, the quantity needed to insure economical production by cold-heading is about the same as required by other production processes. As second operations are required, such as turning, drilling, tapping, and others, larger quantities are needed.

Almost any material can be cold worked, but cold working grades of the following are preferred in the order named: (1) aluminum and aluminum alloys, (2) brass, (3) copper and copper alloys, (4) carbon steels, (5) alloy steels, (6) stainless steels, and (7) silver and other precious metals.

In general, the following tolerances can be considered as commercial without finishing operation, although in some cases special care must be exercised to meet them: length—$\pm$ 0.010" (maximum); fillets—sharp or round, as specified; diameter—0.002" (minimum); and squareness, shoulders, or collars with shank— $\pm 1°$ (maximum). Tolerances for any element, such as length or diameter, vary with the material and with the sizes and proportions of piece, since they in turn determine the equipment or method of heading to be used.

Closer tolerances can be met by adding finishing operations. For example, aircraft studs, bolts, and specials are made in production today commonly to tolerances as close as 0.0005".

Special Inserts

Special inserts are a problem for the design engineer, the manufacturer of the insert, and the molder working in close cooperation. Some of the important phases of designing special inserts are covered, however, in the succeeding paragraphs. Typical applications are commutators and wire connections on telephone handsets and radio resistors. A radio condenser is a good example of a built-up laminated insert.

A general problem for all special inserts is that of anchorage, which depends upon the design of the insert, the thickness of the material molded around the insert, the type and nature of the material being molded, and the design of the molded piece. This and other problems will be discussed under the various types of special inserts.

Thin Tubular Inserts: Anchorage is extremely difficult. Where a tubular insert is molded part way up a molded part, an inverted bead will act as satisfactory anchorage, either for inside or outside inserts. Perforations around the circumference, where permissible, can also be used. When molding an outside tubular insert, it is often necessary to coat the inside of the insert with *Neoprene* or a vinyl to insure better bonding.

Flat Plate-Type Inserts: These can be anchored by

Table 2. Material Wall Thickness (in inches)

Insert Diameters (in.)	1/8	1/4	3/8	1/2	3/4	1	1 1/4	1 1/2	1 3/4	2
Phenolics										
General purpose	3/16	5/32	3/16	7/32	5/16	11/32	3/8	13/32	7/16	15/32
Medium impact	5/64	9/64	5/32	13/64	9/32	5/16	11/32	3/8	13/32	7/16
High impact	1/16	1/8	9/64	3/16	1/4	9/32	5/16	11/32	3/8	13/32
High heat resistant general purpose type	1/8	3/16	7/32	1/4	11/32	3/8	13/32	3/16	15/32	1/2
High heat resistant impact type	5/64	9/64	5/32	13/64	9/32	5/16	11/32	3/8	13/32	7/16
Low loss	5/32	7/32	1/4	9/32	3/8	13/32	7/16	15/32	1/2	17/32
Special for large inserts, flexible properties	3/64	7/64	1/8	5/32	7/32	1/4	9/32	5/16	11/32	3/8
Cellulose acetate	1/8	1/4	3/8	1/2	3/4	1	1 1/4	1 1/2	1 3/4	2
Cellulose acetate butyrate	1/8	1/4	3/8	1/2	3/4	1	1 1/4	1 1/2	1 3/4	2
Ethyl cellulose	1/16	3/32	1/8	5/32	3/16	7/32	1/4	9/32	5/16	11/32
Urea formaldehyde	3/32	5/32	3/16	7/32	5/16	11/32	3/8	13/32	7/16	15/32
Melamine formaldehyde										
Mineral-filled ignition material	3/32	5/32	3/16	7/32	5/16	11/32	3/8	13/32	7/16	15/32
Cellulose-filled electrical grade	1/8	3/16	7/32	5/16	11/32	3/8	13/32	7/16	15/32	1/2
Vinylidene chloride	3/32	1/8	3/16	3/16	7/32	1/4	1/4	9/32	5/16	11/32
Methyl methacrylate	3/32	1/8	3/16	1/4	3/8	1/2	5/8	3/4	7/8	1
Polystyrene	3/16	3/8	9/16	3/4	1 1/8	1 1/2	1 7/8	2 1/4	2 5/8	3
Polyethylene	1/16	3/32	1/8	5/32	3/16	7/32	1/4	9/32	5/16	11/32
Nylon, Type FM-1	1/16	3/32	1/8	5/32	3/16	7/32	1/4	9/32	5/16	11/32
Vinyl chloride-acetate	3/32	1/8	3/16	1/4	3/8	1/2	5/8	3/4	7/8	1

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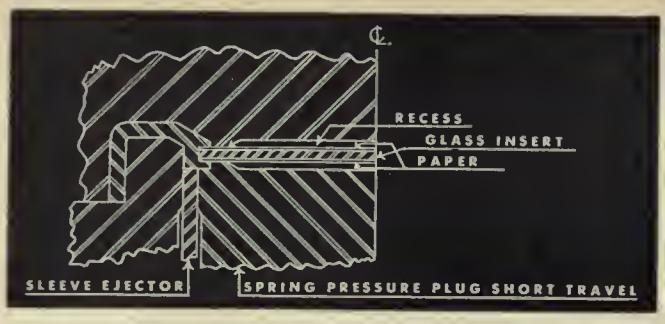

Fig. 8. Sleeve-type ejector method for locating inserts

countersunk holes wherever permissible. All edges should be beveled, or certain sections not required for functioning of the part can be partially cut out and bent over to provide anchorage. For thick metal inserts, bosses can be extruded and slightly flared to act as satisfactory anchorage. Anchorage may also be obtained by spot-welding lugs to the underside of the insert.

DRAWN SHELL-TYPE INSERTS: Especially where minimum wall thickness is specified, anchorage is a great problem because of danger of cracking. To provide the best possible anchorage, the insert should be flared in slightly so that the plastics can anchor the insert and creep while shrinking.

DRAWN PIN-TYPE INSERTS: Often an insert of this type is molded into the plastics and then countersunk. Although a slight head is provided as an undercut for anchorage, it is insufficient to hold the insert properly. Wherever possible, piercing pins should be provided so that the insert can be pierced during molding and the necessary countersink molded into the plastics. During the piercing operation, the insert should be flared out. Fig. 5 shows a drawn-type pin with an open end. Partial anchorage is obtained by shearing and folding two segments during molding. Floating pressure-type piercing pins are recommended to minimize flow of plastics into the insert.

DRAWN SHELL THREADED INSERTS: These are often used on large molded parts where it is not necessary to have 75% of thread, or where insert space is limited. Because the shell is usually thin, approximately 50% of the thread depth is obtained. The four flared lugs provide a satisfactory anchorage. It is impossible to provide sealing points on an insert of this type and, hence, flow of material into the thread must be expected. Tapping after molding is recommended for most satisfactory results.

INTRICATE INSERTS: An intricate insert is shown in Fig. 6. Aluminum inserts minimize danger of cracking because of aluminum's coefficient of expansion and its ability to give or spring slightly as the plastics shrinks.

LARGE SURFACE INSERTS: These cause non-uniform shrinkage of plastics and considerable warpage. Regardless of type or method of shrinkage or cooling fixtures, one surface will be convex and another concave after the piece cools and ages. Machining is required for a flat surface. Best results are obtained when the part is aged before machining or, if possible, is baked in an oven for at least 72 hr at suitable temperatures.

LARGE INSERTS WITH A MINIMUM WALL THICKNESS OF PLASTICS: Where a minimum thickness of plastics is allowed around a large insert and the part calls for thermosetting material, a special non-cracking type will generally have to be used. Sharp corners or other features which might create local stresses must be avoided.

IRREGULAR-SHAPED INSERTS: These inserts cause the greatest difficulty. Fig. 7 shows a U-shaped insert, approximately 1½" long, on which two rib projections are required above the plastics. Though it is economical from the standpoint of forming the insert and loading it into the mold to make it from one piece, doing so will lead to cracking of the plastics. Thus, it would be more economical in the long run to make two separate inserts. A wire can be fastened between the two inserts for electrical contact; or, for a more solid connection, the insert can be made solid with cut-out slots. If so, provision must be made in one half of the mold to prevent the slots from being filled with plastics. When these slots are open, there will be a slight give in the insert when the plastics shrinks, thus reducing or eliminating the possibility of cracking.

When a long bar-type insert is used, an anchorage should be provided in the middle of the bar by grooves or slots. The center anchorage will allow the plastics to creep along the surface of the insert while it is shrinking toward the center. If the part is cylindrical, circular rings will give satisfactory anchorage and at the same time allow the plastics to creep uniformly around the periphery of the insert.

Non-Metallic Inserts

Inserts of various materials may be used, such as wood, glass, porcelain, rubber, etc. Wood inserts are used as a core, especially for thermoplastic materials and mainly in compression molding. Their use in such applications as door-knobs and automobile gearshift knobs saves considerable material and shortens the molding cycle.

Glass inserts are molded into thermoplastics by injection, into thermosetting materials by transfer. Greatest difficulties are caused by the non-uniformity of contours and dimensions. Being brittle, glass does not lend itself to the application of full clamping pressures during molding without the possibilities of breakage. Cushioning by springs or rubber should be provided to compensate for the normal irregularities. In some cases, paper is glued to glass to cushion it and also to prevent scratching during handling.

Locating the insert in the mold is difficult. Fig. 8 illustrates a sleeve-type ejector method. The inside sleeve diameter is of the same size as the glass insert. The insert is located by being placed inside the ejector sleeve when it is protruding in ejected position. Fig. 9 illustrates a step-molded part. One step must have the same diameter as the outside diameter of the insert. A sleeve-type ejector is used on this step. The insert is located by the inside of the sleeve. It is recommended that all but a small outer surface of the pressure plugs be recessed as shown in Figs. 8 and 9. This will allow a small steel surface contact with the insert and minimize the possibilities of breakage.

Porcelain in tubular form is used as an arc-protecting material. In some cases, a porcelain tube is placed over a wire insert and allowed to protrude from the plastics. In case of arcing, the arc is on the porcelain instead of the plastics.

Hard rubber and melamine inserts are used to prevent tracking, especially when revolving contacts are used.

In many applications plastics parts must withstand high internal pressures. In molding inserts into such parts, it

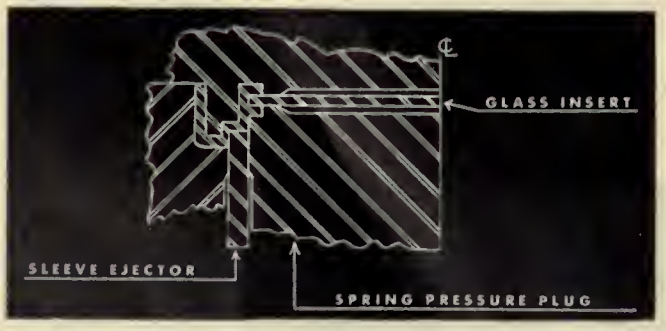

Fig. 9. How to locate an insert in a step-molded part

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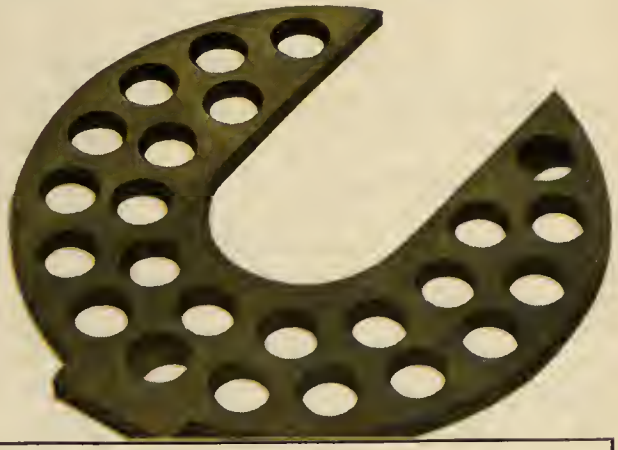

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is usually impossible to have the insert remain airtight within the plastics, even under minimum pressures. To retain a tight joint, a flexible wall of other material is required between plastics and insert. Under expansion and contraction, a very thin coating will compensate for any difference in coefficient of expansion between metal and plastics. A few successful methods of coating are recommended. The insert should be knurled as for normal anchorage and at least two grooves provided approximately 1/32″ wide and 0.020″ deep. The head or the anchorage part is then dipped in a rubbery synthetic and oven-dried. It is possible also, especially on round inserts, to provide a groove in the anchorage head large enough for a *Neoprene* washer. Under normal molding conditions, the washer will provide satisfactory results. On some applications, a retaining groove is molded or machined between the insert and the plastics. The groove is filled with *Glyptal* and allowed to dry at room temperature, or is oven-baked.

Preparation of Inserts Before Molding

Inserts should be carefully washed to remove metal chips from the threads and fine metal dust from the knurls. These impurities are often rolled on to the surface by knurling. Though not easily washed off, they are loosened by plastics flow and often work to the surface and impair the appearance of the molded part. The most serious result, however, is in electrical applications where a small particle or slight metal dust will cause a total breakdown electrically. Grease and oil are also detrimental to the appearance of molded parts.

Cleaning processes are divided into three types: (1) mechanical, including hand polishing, tumbling, shot- or sand-blasting, solvent de-greasing, and alkali washing; (2) chemical, such as removal of iron rust and silver tarnish by an acid bath; and (3) use of electrolytic cleaners. Oil and machining chips can best be removed by a well-stirred alkali bath followed by a rinse with hot water, except where the nature of the metal, such as aluminum, rules out the alkali in favor of de-greasing with solvent. In many cases, a reasonable amount of tarnish can do no harm but where the function or the appearance of the piece demands chemically clean inserts, an acid dip is necessary. For brass and bronze a mixture of nitric and sulphuric acids or nitric alone is commonly used. Silver tarnish can be removed with nitric acid or a diluted solution of one of the cyanides. *Oakite No. 32* has been found an efficient remover of iron rust.

Sealing Points Minimize Flash

Most of the flash difficulty can be avoided in the design of the part and the insert by providing sealing points so that the flow of plastics is cut off or at least minimized. However, even with the best design, there will be some material on the inserts, especially when the mold wears or close tolerance on the inserts is not maintained. When the inserts are plated and polished, there is only a minimum possibility. Methods recommended for eliminating even this possibility include lubricating the insert prior to molding with wax, soap, grease, or oil. Flash should be cut close to the molded part and peeled off. Usually a mild solution of caustic soda will loosen it so that it can be easily removed. This method, however, requires extreme caution because too long a time or too strong a solution will harm the surface of the part and may even loosen the insert in its anchorage.

Through-type inserts can be knocked out by a foot press and fixture. When they are anchored part way in the material, a strong solution of caustic soda will loosen them in thermosetting material so that they can be picked out. For thermoplastics, suitable solvents or heat may be used.

Considerable stresses are set up in molded parts of irregular design, such as parts with thin and thick sections, and especially parts with metal inserts. The best method to relieve stresses is to allow the part to cool slowly. The ideal condition would be to carry the parts on a conveyor through an oven which has various stages of temperature, starting at 50° below the molding temperature, then gradually decreasing until the part is cooled to room temperature. This method, however, requires special equipment.

The next best method requires two ovens, one at approximately 225° F and one at 150° F. The molded part remains in the oven until its temperature is reduced to oven temperature. The final step is room temperature. In case of thermoplastic materials, molding stresses are relieved by a baking process at suitable recommended temperatures.

Method of Pressing in Inserts After Molding

It is often economical to press in inserts after molding. Best results are obtained when done at the press. In most cases a fixture is designed and mounted in a small arbor press or punch press. If there are several inserts in the part, they can be pressed in in one operation. Best anchorage is obtained when the inserts are pressed in immediately after the part is ejected from the mold.

When designing a mold for pressing in inserts, the shrinkage of material, the size of the insert, and the allowance for anchorage must be considered. On small inserts it is safe to allow from 0.001″ to 0.002″ above the shrinkage of material. On large inserts, however, as little as 50% of the shrinkage is used for anchorage, especially when there is a small wall of material. For example, if an insert 4″ in diameter is to be molded with a ¼″ wall of plastics, the plastics will crack. On the basis of 0.008″ shrinkage per inch, the material will shrink 0.032″. If the same insert is pressed in after molding and only 0.016″ is allowed for anchorage, there will be no danger of cracking.

Both diamond and straight knurl give satisfactory results in pressing in inserts. In certain special applications, a coating of adhesive may be applied on the insert to help anchorage and assist in obtaining an airtight joint. END

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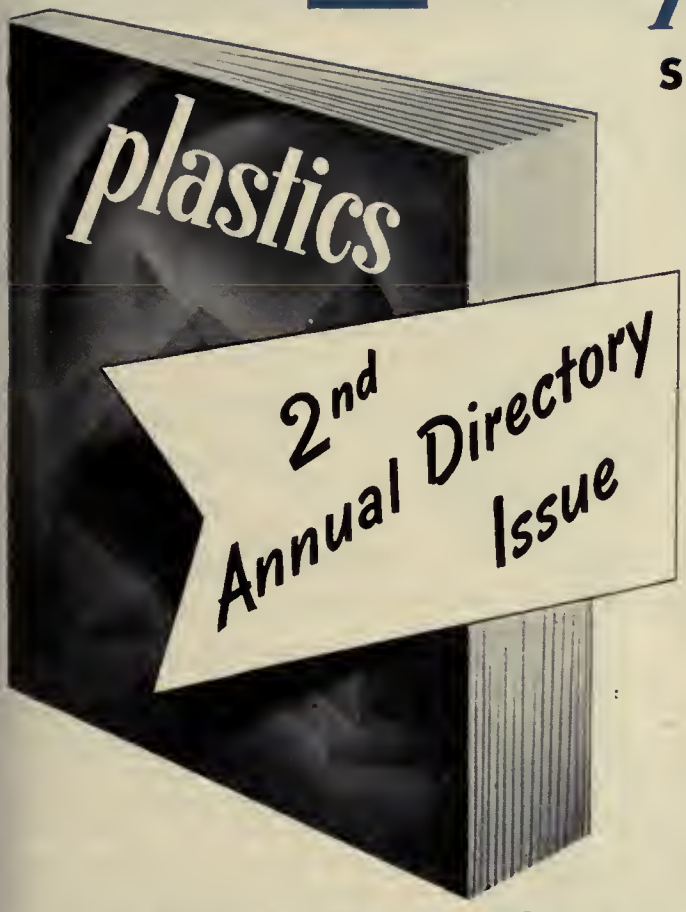

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CAPITAL Report

By Arnold Kruckman

plastics Washington Correspondent

IN THE plastics industry the impression is well defined that materials will flow more readily and easily after the new tax schedules become effective. It is said, in the Capital, that a better supply of molding powders is bound to be available to enable fabricators to get really under way. There also will undoubtedly be more firm orders from the industries which use the products of fabricators, such as parts that go into washing machines, radios, refrigerators, vacuum cleaners, electric irons, and the numerous other articles of which plastics parts are important components. A survey made by OCR shortly before it was dissolved revealed some demands which should be very interesting to the plastics industry. Conducted by the expert canvassers of the Bureau of the Census, who are probably the most highly skilled house-to-house "quizzers" in the world, having gone through a long and detailed training before they are considered qualified for the work, their "samplings" are so well planned and organized that the results reveal, within a fraction, what the whole nation wants and thinks about specific subjects.

This last OCR survey showed that the greatest over-all demand in cities, towns, and on farms, is for (1) radios; (2) vacuum cleaners; (3) mechanical refrigerators; (4) washing machines; and (5) electric irons.

Requirements by Locale

There is also an enormous demand for sewing machines. It was found the West and the South wants, in the order enumerated, mechanical refrigerators, washing machines, electric irons, radios, sewing machines, and vacuum cleaners. In the North Central States washing machines headed the list, with refrigerators third; The West, meaning the eleven States on the Pacific side of the Rockies, is eager to buy anything that is offered. The South demands twice as many vacuum cleaners as it has ever purchased; and it wants large numbers of mechanical refrigerators. The greatest immediate demand for radios in all sections is in the lowest income groups. Farmers want refrigerators more than anything else. It is reported the greatest over-all market for anything and everything that may be offered is among the families with income ranging from $40 to $60 a week, these families constituting well over one-fourth of the buying group of the nation. While the things themselves have no immediate relation to plastics, there should be a valuable hint of possibilities in the report that the articles most widely in demand everywhere are, in the order named, clothespins, alarm clocks, window screening, galvanized washtubs, appliance cords, scissors, shears, silverplated ware, outside garbage and ash cans, chests of drawers, wood or metal bedsteads, and galvanized wash boilers.

It was found that many people feared high postwar prices, and almost as many appeared to be reluctant to buy immediately because they had the idea that materials, in the first wave of output, would be poor, and workmanship indifferent, this apprehension applying, in some degree, to plastics. Observers in Washington believe that the paramount job of producers and distributors is to sell the idea that the first new postwar products are of good quality and are well made. Experts at distribution in the Department of Commerce feel that the original output might have hard sledding unless the salesmanship and advertising used in connection with it are handled with consummate skill.

OPA's Aims

OPA's object is to check inflation, and permit prices and profits to encourage quick reconversion by: (1) focussing on dominant products and giving more freedom to items unimportant in cost of living or in key industrial cost-price relationships; (2) taking over-normal profit margins and using their excess to prevent price increases despite necessary cost increases; (3) cause wholesalers and retailers to absorb price increases which may be allowed manufacturers; (4) give reconversion producers the incentive in price relief when they make key items; and (5) give help to any manufacturer who is running into the red. Those who can qualify as manufacturers of "reconversion products" stand highest on OPA list for price relief. The list of products includes building materials and items used in equipping buildings; durable goods, including portable air conditioners, bicycles, carpet sweepers, clocks, small electrical appliances, office machines, store machines, playground and gymnasium equipment, radios, phonographs, and radio-phonograph combinations; mechanical refrigerators, sewing machines, household and health scales, thermostats, vacuum cleaners, washing machines, ironers and driers.

The Supply Picture

Commerce Department reports that benzol demand appears to be absorbing the supply; toluol, no longer a military need, became so plentiful the price was reduced, and the supply derived from petroleum has been reduced; there is now a Government stockpile of 15,000,000 to 20,000,000 gal, which might upset the domestic market, for which reason it has been urged it should be sold abroad.

Between 80% and 85% of the facilities now available to produce phenol are reported sufficient to supply civilian needs; the present stock of phthalic anhydride is considerably in excess of commercial needs; acetone is more ample, and is offered at 6¢ to 7¢ a lb in tank cars. It is expected that formaldehyde production for the year will be slightly more than last year. Casein production was the lowest in 25 yr, and supplies have been inadequate. Argentine shippers are asking 22¾¢ per lb delivered in the U. S.

Phthalate plasticizers are reported relatively free, but production apparently waits upon developments. Phosphate plasticizers have been made easier in supply by release of military stocks. Cellulose acetate and cellulose acetate butyrate are reported as greater in supply. Alkyd resins appear satisfactory in prospect to the Department of Commerce, as do phenolic resins. Polystyrene and polydichlorostyrene appear to the Commerce experts as potential competitors with the acetates. Silicones, one of the recent war-born plastics materials, is regarded by the Government people as a tremendous peacetime potential.

Surplus Plastics

Reconstruction Finance Corporation Surplus Office lists a quantity of plastics for disposal, including electric fittings, glass, cellulose, condensation plastics, cellulose plastics, synthetic plastics materials, polymerization plastics, protein plastics, and plastics construction and maintenance products. Roughly, the materials and articles cost the Government about $1,000,000. They may be seen, or complete information about them may be obtained, in the RFC offices at Atlanta, Birmingham, Boston, Charlotte, Chicago, Cleveland, Dallas, Denver, Helena, Houston, Jacksonville, Kansas City, Little Rock, Los Angeles, Minneapolis, Nashville, New Orleans, New York, Oklahoma City, Omaha, Philadelphia, Portland, Richmond, St. Louis, Salt Lake City, San Antonio, San Francisco, Seattle, Spokane, Washington, D. C., and Fairbanks, Alaska. END

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insulated with paper laminates. Rayon yarn is wound and dried on spools made of laminated paper tubing. Aluminum aircraft parts are formed over jigs made of paper laminates. The Armed Forces use paper laminates in many ways: in Ordnance, Chemical Warfare, and Quartermaster supplies, radio, radar, and aircraft. There is scarcely an industry or activity that does not today use paper laminates in some form or other, and the scope of the applications is steadily expanding. Lessons learned from war-time experimentation and development in hundreds of research laboratories are sure to lead to improved paper products and their rapid adaptation to urgent civilian wants.

Typical Applications

A few typical applications will be examined more closely. An excellent illustration is a refrigerator breaker strip. An insulating barrier is required between the warm outside shell and the cold inside of the refrigerator to prevent sweating and to maintain thermal efficiency. Thus, the primary function of the breaker strip is heat insulation. The breaker strip may or may not serve as a structural part of the assembly. In any case, however, it must be sufficiently rugged to stand the normal abuse which occurs, particularly on the bottom sill. It must resist moisture and be dimensionally stable when subjected to varying humidities. Lastly, it must present a good appearance and have good wearing qualities so that the finish does not deteriorate with use. Paper base laminates answer the above requirements admirably. They have the required heat insulating properties combined with the needed structural strength. They are resistant to moisture, dimensionally stable, and have a hard, long-wearing surface.

Structural Use

Aircraft flooring may be considered as an excellent example of the use of the material as a structural application. Strength, light weight, and durability are the prime considerations here. The loading on a floor is primarily flexural or beam loading, and in such a structure the highest stresses are at the outer surfaces. This situation can best be met by the use of a sandwich material or similar structure. In this case, the selection is a sheet consisting of a plywood core and paper laminate surfaces. As the load is borne largely by the surface, the strongest type of paper reinforcement is chosen. This will be composed of a thin directional paper made from a not too highly refined pulp, probably a sulphate or Mitscherlich sheet. Moisture absorption and dimensional stability are not of too great importance here, as even a poor grade of paper laminate is better in this respect than the plywood core material; therefore, such a sheet will be satisfactory in this respect. Finally, it must be considered that relatively low molding pressures must be used so that the plywood is not crushed in the pressing operation. Therefore, a relatively hard paper is used so that the degree of compression required is relatively low and can be accomplished without damage to the plywood core. The result is a composite material which can truly be said to be engineered to the application for which it is intended.

Fuselage Doors

A final example is the use of paper laminates in the fuselage doors of one of our medium bombers. There are two of these doors per ship, and their prime function is to seal off the mid-section, where the bombs are, from the forward and tail ends. The door consists of two sections, a flat sheet and a molded part, the latter resembling a shallow elliptical pan with a narrow flange and three raised areas in the center where the flat sheet is cemented to the molded part.

This construction, fully using the high-strength low-weight ratio of paper base laminates, results in a structurally sound door of light weight and extreme rigidity. During the bomb run, while the bomb-bay doors are open, these fuselage doors take the full impact of the incoming air, which creates a partial vacuum behind the front door and a positive pressure against the rear door. Besides the stresses created by these loads, the doors must resist the climatic conditions encountered in flight, including high

Table II. Differences in Properties of Variously-Reinforced Laminates

	Mitscherlich Sulphite	Sulphate Kraft	Alpha	Rag	Fabric
Paper Characteristic					
Basis wgt. (lb/24" by 36" by 480), 5% H_2O	30.0	93.0	79.0	48.5	
Thickness (mils)	3.0	11.0	10.0	7.0	8 oz.
Density (lb/mil)	10.0	8.4	7.9	6.9	Cotton
Oil penetration (sec)	2.0	6.0	3.0	1.8	Duck
Gurley Densometer (sec/100 cc)	15.0	7.5	4.0	7.5	
Type Resin	Phenolic	Phenolic	Phenolic	Phenolic	Phenolic
Resin Content (%)	40	40	40	40	40
Physical Properties					
Tensile strength (psi)	30,000	21,000	18,000	16,500	11,000
Modulus of elasticity	2.4×10^6	2.0×10^6	1.6×10^6	1.25×10^6	0.9×10^6
Compression flat (psi)	47,000	45,000	40,000	42,000	40,000
Compression edge (psi)	23,000	23,000	20,000	20,000	20,000
Flexural strength flat (psi)	35,500	28,500	26,000	22,500	19,500
Izod impact (ft lb/in. notch)					
Flatwise	4.50	1.95	1.50	1.65	4.5
Edgewise	0.78	0.55	0.50	0.57	3.0
Bonding strength (lb)	850	975	1,250	1,175	1,850
Shear (psi)					
Flat	14,000	16,000	14,500	13,500	12,000
Edge	8,000	10,000	8,000	7,500	9,500
End	8,500	9,000	8,000	7,500	9,000
Water absorption (%)	2.6	2.2	1.5	1.4	2.5
Density	1.41	1.40	1.41	1.42	1.35

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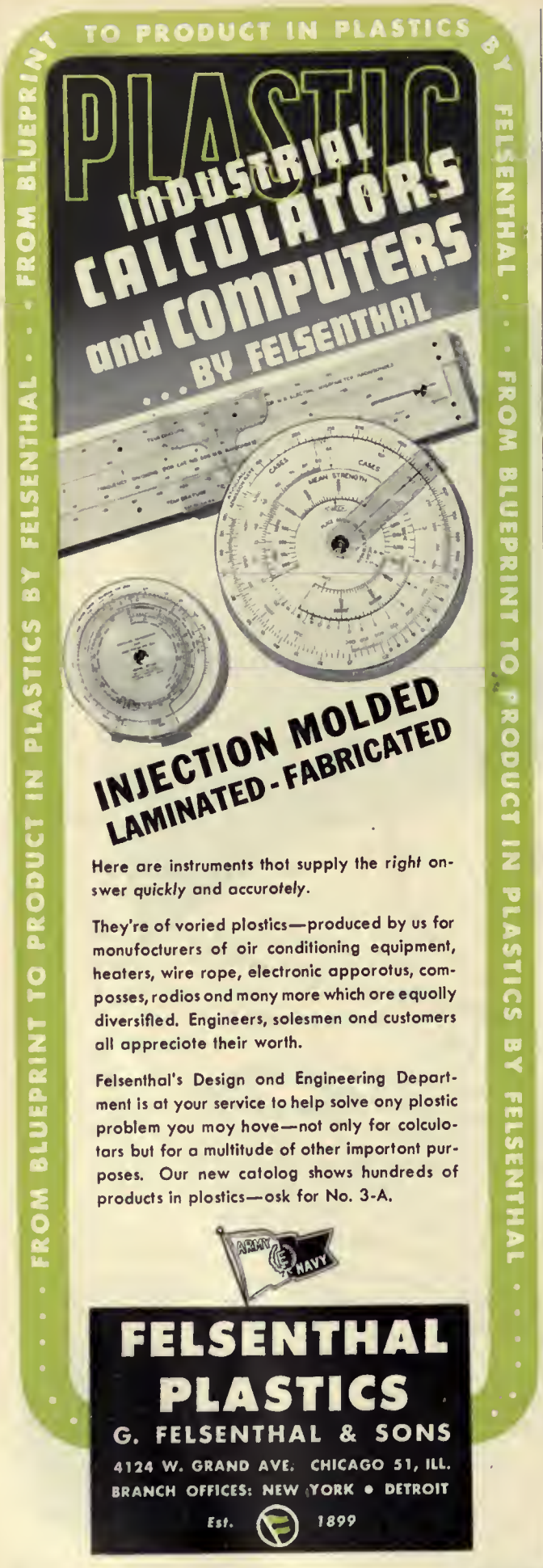
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humidities and low temperatures. Also, the vibrational dampening characteristics of paper base laminates are greatly superior to the metal previously used for this part, thus eliminating the danger of failure from this source.

Paper laminates have for some time been standardized throughout the industry, particularly insofar as electrical applications are concerned. Standards are published by NEMA and ASTM, and are covered as well by various Government specifications. Yet, despite the fact that they may be counted among the older plastics, the paper laminates have not reached a dead end. New developments are taking place in both their composition and the process of making them; they are also finding increased application. Resin research is active, and manufacturers are constantly bringing forth new types of resins and improving the older types. Simultaneously, much work is being done to develop new techniques, particularly in the manufacture of special shapes or molded laminated forms. It should be the function of the paper maker not only to work toward the development of papers for the quality improvement of laminates, but also to work with the laminator to develop papers suitable for particular molding problems.

Advantages Offered

Paper-based laminates offer such advantages as low cost, ease of fabrication, machinability, high strength in relation to weight, good insulating properties (both thermal and electrical), and durability. It must be remembered, however, that the exact characteristics and properties of the finished laminate can be varied considerably by the type of paper chosen as the laminate base. END

Plastics in Perspective

(*Continued from page* 26)

with the same information, except for the trade name. A possible compromise worth bearing in mind for the future is the use of a label of the type: Acetate—*Lumarith*—giving the general chemical type and the trade name. This would be practical if the consumer can assimilate chemical names, and if the product was made from the material of one manufacturer.

Too Much Information Not Desirable

Second objection to the recommended label is that too much information is given. This is not serious, since one can eliminate what one pleases. We suggest that the description "light in weight" and "warm to touch" are unnecessary since these would be obvious when one handled the object. Also, we believe that "color-fast" is sufficient color information, and that "color solid throughout" is redundant even though it means more than "color-fast."

Third possible objection relates to the negative instructions, such as "use no abrasives" and "avoid flame." While some people feel that negatives discourage sales, we heartily agree with the committee's recommendations. We have found that, in other commodities, we as consumers are glad to be told how to use them and what to avoid.

We think the SPI pamphlet is good, and we said so last month. It does not presume to lay down rigid procedures, but only to act as a guide. The question of trade name versus chemical name or the combination suggested will have to resolve itself in time. END

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A Consumer Speaks Up!

By Wynn Stephansen

Customers or potential customers—in the dark about plastics—plead for simple terms, educational publicity, full labelling

THIS is an appeal to the plastics industry from an American housewife. I want to be able to buy plastics merchandise as intelligently and with as much discrimination as I do metal, wood, or leather goods.

As an American I know what I want. When I go shopping for gloves, I know whether I need something heavy and durable or dressy and therefore fragile. So I buy pigskin or kid accordingly. When I buy a dress, I know whether I need the warmth of wool or the coolness of linen, the crispness of taffeta, or the softness of jersey. I know the characteristics of the merchandise I buy, and I know what to ask for in order to get it.

Yet when I shop for an item made of plastics, I am tongue-tied. If I want a shower curtain or a raincoat or a handbag, all I can ask for is "something in plastics——you know what I mean——washable." I am as helpless as though I had to find an aluminum saucepan by asking for one that is "light-weight and shiny and silvery color."

The American housewife never thinks of tweed and satin, flannel and organdy as "cloth"—she buys each by name. Yet, confronted with articles of phenolics and ureas, vinyls and acrylics, she lumps them all together as "plastics" and credits them with more or less identical characteristics.

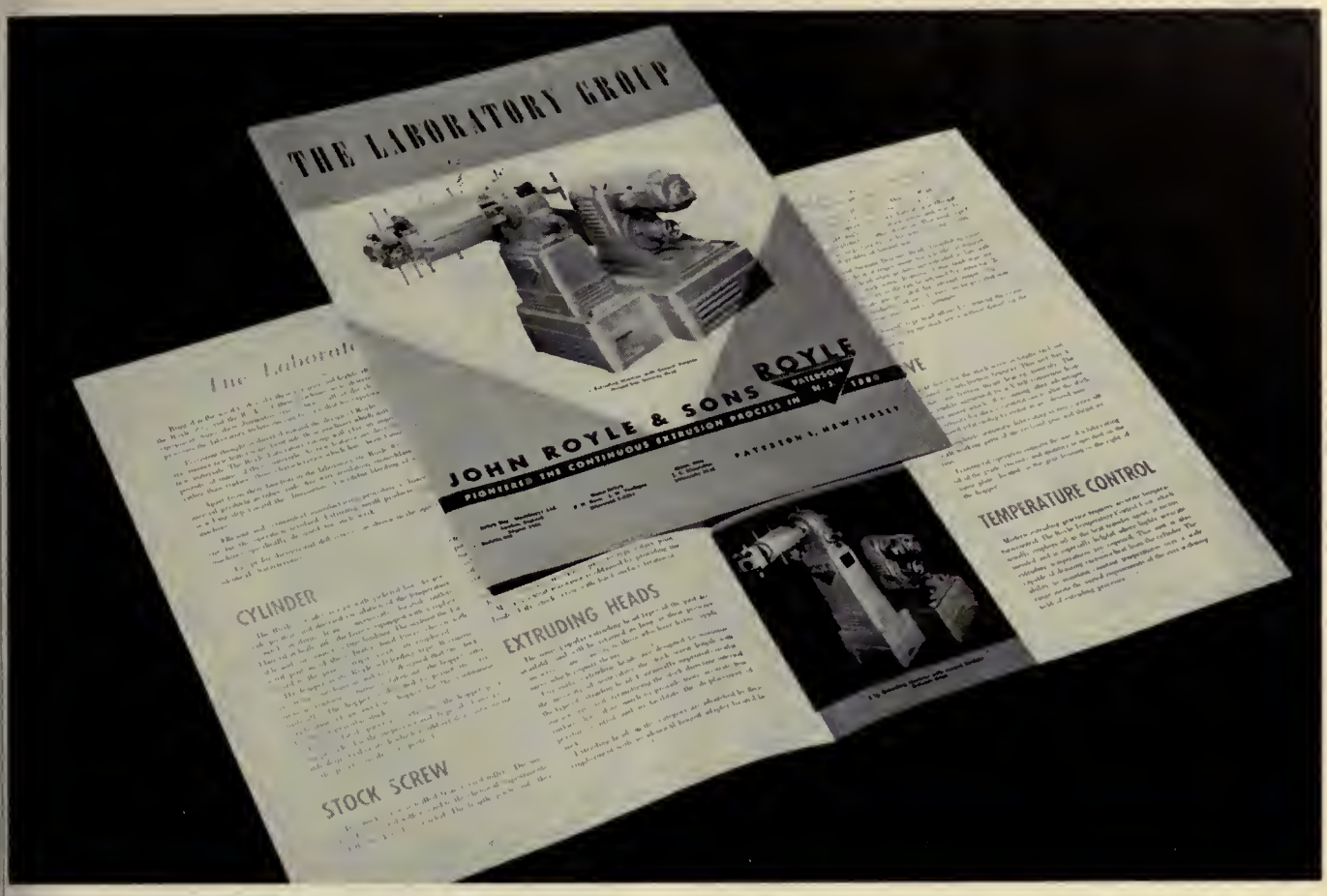
A group of business and professional women, all of above average intelligence, were recently asked two questions about plastics: "What do you like best about plastics products and what do you most dislike?" "Which plastics items are you eager to buy when they become available, and which do you intend to avoid?"

Their preferences were strong, but their lack of specific knowledge was amazing. Only one woman objected to the questions, "But you can't lump plastics together like a single material—they vary too much!" Not one made any attempt to distinguish between the various kinds, except by their application or appearance. None would speak of "leather gloves" or "wooden furniture;" every woman would know at a glance whether a dress were made of cotton, rayon or wool. Yet to describe a tea-tray as "made out of some kind of plastics" is actually as absurd as to describe a dress as "made out of fabric of some kind."

Only one woman mentioned a trade name of a plastics: "My *Lucite* cigarette case is the loveliest thing I own." The women knew by observation that some plastics are transparent and some opaque, some solid and some flexible—but at that point their knowledge ended.

It is the fault of the plastics industry that the public remains so uneducated on the subject. Ignorance will prevail until the industry settles on short, easily-remembered names for the various kinds of plastics in place of the tongue-twisting chemical names familiar only to the trade. The sooner polystyrene, methyl methacrylate, and vinyli-

(*Continued on page* 118)



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There Will be More Materials in 1946

PMMA survey reveals that extensive expansion programs of plastics producers promise to overcome shortages now hampering industry

PLANT and equipment expansions now under way in the materials manufacturing industry will be adequate to meet all reasonable demands for plastics molding powder and resins in 1946, according to a survey just completed by the Plastics Materials Manufacturers Association, and announced by F. H. Carman, its general manager. Other factors effecting quicker deliveries of materials to the end user, are building materials, building labor, and special equipment, but one of the most disturbing factors, the survey determined, is the extremely critical labor supply in the materials manufacturing industry.

However, the survey reassures all engineers, and others contemplating the use of plastics in their products, that there is no need to delay in drawing up their plans or proceeding on the assumption that 1946 and 1947 deliveries of molding materials and resins will be adequate and on schedule.

The survey is based on authentic reports and is carefully compiled to present an unbiased picture of existing and future conditions among PMMA members. It points out that one of the most important phases of the supply picture of interest to the entire plastics industry is the expansion program now being undertaken by many materials manufacturers. Generally, it can be said that manufacturers of most of the newer types of plastics, who did not make large expansions during the war years, are now planning additional facilities for their respective materials. Many of these expansions have already been announced to the industry, and others are still pending.

A conservative estimate of the plans of the association members alone is that new facilities for production of plastics materials will entail expenditures amounting to 102 million dollars during 1946 and the early part of 1947. A major portion of these new facilities will be for the production of molding materials. This, in itself, is the best example of the optimism of the material manufacturers for continued growth of the plastics industry.

Completion dates of new facilities vary considerably. Whether or not any given expansion program can be carried out on schedule depends upon building material supply, building labor, and the ability of the equipment manufacturers to turn out special types of equipment required in a reasonable time. Barring unforeseen delays, many of the expansion programs will become effective in the spring of 1946 and thereafter through the middle of 1947. In the detailed discussion of the availability of the various materials, increased supplies from new facilities are mentioned by dates whenever practical.

One of the most disturbing factors in the present supply situation is the availability of labor. Generally, the supply is extremely critical in areas in the east and New England. In other areas, there is sufficient labor to operate plants at or near capacity. Where labor is tight, the manufacturers are operating longer work weeks and using all possible means to maintain full production schedules. However, the urge to work overtime, especially on Sundays, is no longer a production aid. This complicated situation may well account for the fact that some molders are not obtaining what they consider is their rightful share of any given producer's production at this time.

Manufacturers of phenolic molding materials are being severely hampered by shortage of wood flour. It has been extremely difficult for the last two or three months to obtain good quality material in sufficient quantities. Continued strikes in the lumber industry on the West Coast and the insufficient conversion capacity in this country may eventually choke off the supply. It is hoped improved labor situation and possible resumption of wood flour imports from Scandinavia will relieve this shortage.

A strike in the steel industry would eventually slow down coking ovens, thus curtailing tar acids supplies. These labor difficulties, together with shortage of labor in the material manufacturers plants and in many of the molders and fabricators plants, are and may continue to materially restrict the amount of plastics that are actually consumed.

Other material shortages are insufficient supplies of cellulose acetate flake, for which ample expansion of facilities is now going forward; critical supply of cotton waste, which could restrict production of impact materials should the demand become heavy; and possible uncertain supplies of coloring pigments for styrene molding materials when the large expansion of this plastics becomes effective.

Reports to the association indicate the following for various types of plastics materials:

Phenolic Molding Materials

Most producers are severely curtailed by shortage of labor and wood flour, and are currently unable to run at capacity. It is estimated that producers are now operating at about 70 percent of capacity. Unless there is a material change in wood flour availability, production will fall off still more in the immediate future.

Assuming that wood flour and labor become available in the early part of 1946, it is estimated that new facilities will allow about a 16 percent increased material supply, based upon present capacity of manufacturers. Expansion of facilities now pending, and in some cases already started, will permit approximately a 42 percent increase over present capacities during the early part of 1947.

Urea and Melamine Molding Materials

Manufacturers now in production are operating substantially in excess of 90 percent of total capacity, and the amount now available to molders is approximately 25 percent in excess of that during 1944. Shortage of labor is the only item restricting operations. It is anticipated that new facilities and additional labor, together with another producer resuming production of urea molding materials, will effect a 25 percent increase over the present rate of production starting this April. Announcements of expansions in molding powder production to become effective during the latter part of 1946 or early 1947 will permit production at a rate 80 percent higher than the current levels.

The shortage of these materials has been fairly acute,

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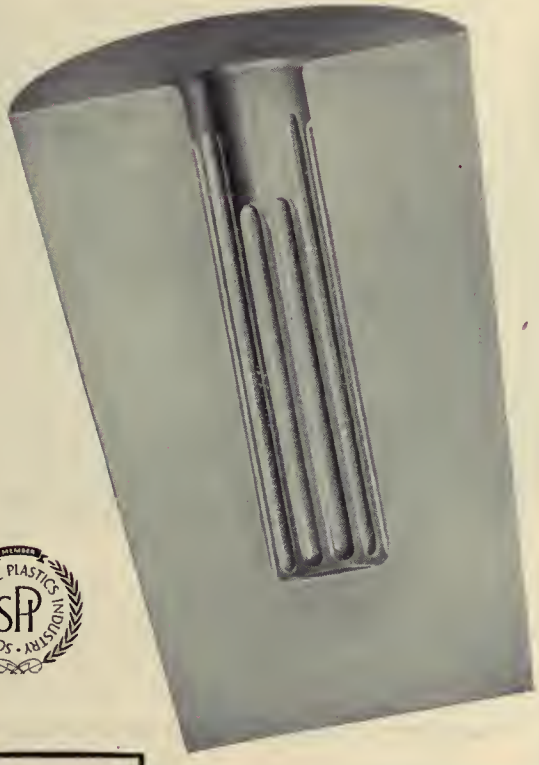
Whether you are a custom molder, a manufacturer operating a molding department, or a purchaser of molded parts, there is some phase of our facilities and knowledge that should be of interest or help to you.



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Here is a very practical heat treating treatise that will help you get the best performance from Hobbed Cavities by Midland.

This book gives complete information about Midland organization, experience and facilities.

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New Precision Built Roto Center Eliminates Chatter... Speeds Production!

Now you can replace dead centers on lathe and grinder tailstocks, with this new Keene live Roto Center—to increase production—to eliminate all radial play and possibility of chatter! Low in cost, the Roto Center is a high capacity unit, featuring many innovations to speed and improve quality of work!

The Keene Roto Center

Matched roller bearings preloaded, are packed with high grade antifriction grease at assembly. No attention is required for long periods. After assembly, runout is kept to absolute minimum—guaranteed less than .0002. Rear of center is tapped to receive standard hydraulic fitting. Chips, dust and cutting oil cannot reach bearings!

More and more peacetime "helps on the job" are returning to industry. One of these days, famous, flavorful Wrigley's Spearmint Gum will also be back to help you "on the job"—but only when we can assure Wrigley's Spearmint manufacture in *quantity* and *quality* for all. Today, we ask you to remember the famous Wrigley's Spearmint wrapper. Tomorrow, you may again enjoy Wrigley's Spearmint Gum quality and flavor while you are at work.

Remember this wrapper

You can get complete information from Keene Electrical Machinery Co., 549 W. Washington Blvd., Chicago 6, Ill.

Z-95

partly because of increased molding facilities made available during the war period and the fact that large expansions by the material manufacturers were not possible during the same period. Substantial increases in manufacturing facilities are included in the tremendous expansion program already mentioned for the entire industry. Estimates from PMMA members indicate that consumers may anticipate approximately a 33 percent increase in production during the first quarter of 1946. Expansions now under way and pending will continue to bring in additional capacity during the year; and by the second quarter of 1947, it is anticipated that thermoplastics availability will be increased by about 150 percent of the present level. The supply situation for the specific grades follows:

Cellulose Ester Molding Materials—The industry is now operating substantially at capacity, although additional acetate flake in a few instances would permit even larger tonnages. Additional facilities may make it possible to increase the present rate by approximately 6 to 10 percent in the first quarter of 1946.

New Facilities Provide Higher Capacity

Among PMMA members, new facilities for the manufacture of flake as well as molding materials, already announced and pending, to be brought in during the latter part of 1946 and through July, 1947, will ultimately provide manufacturing capacity 53 percent in excess of present production.

Polystyrene Molding Powder—Producers are operating substantially at capacity of the present equipment, and there has been considerable increase over the average production of 1944.

New facilities now under construction should provide additional material during the early part of 1946, amounting to an increase of 135 percent over current supplies.

Long-range expansion of facilities, already announced or pending, may permit production in the magnitude of a 600 percent increase, based on present operation. This appears to be the largest expansion program for any given plastics material now under consideration.

Acrylic Molding Powder—Producers report operations at capacity with demand considerably in excess of supply. It is anticipated that substantial increases during the first quarter of 1946 may increase the present supply by approximately 20 percent. Expansions requiring a year or more are now under way, and producers feel that the new capacities will be sufficient to take care of all demands.

Ethyl Cellulose Molding Material—Producers have already brought in substantial expansions which are now becoming effective with increased material. Availability in the early part of 1946 may be further increased by about 13 percent, and by the first quarter of 1947 by approximately 36 percent of the present supply.

Polythene and Nylon Molding Material—The present capacity is sufficient to meet demands. However, anticipating future requirements manufacturers will have greatly enlarged capacities available during the first quarter of 1947.

Polyvinyl Chloride and Copolymer Resins

Shortage of labor is holding production of the compounding plants at approximately 70 percent of capacity. Because of the time required to expand facilities, consumers can anticipate increases only as labor becomes more plentiful. It is believed that this labor problem will gradually improve from now on. Over a long term, it is anticipated that compounding capacity for vinyl resins will be increased by about 100 percent. It is therefore evident producers are preparing to take care of customers' total requirements.

There appear to be substantial quantities of polyvinyl

Gosh! the boss is a New Man...

since we stopped fooling around with

STOCK RESINS

And I mean fooling around—because that's what he told the boys in the plant. He said no two shipments of stock resin we got ever performed alike, or why were we always having downtime while trying to "adjust" resins to the job. He turned the whole thing over to Interlake. They made a specification resin for us—and that fixed everything.

INTERLAKE develops each specification resin to order—with properties precisely adjusted to *one specific application*—tests it on the job—then so stabilizes production of that resin that the performance of every shipment delivered is identical with the first.

Thus users of Interlake Resins—completely relieved of the task of fitting the resin to the job—are assured of dependable, uniform performance.

BRING YOUR RESIN PROBLEMS TO INTERLAKE. Our experienced research men are glad to work with you on any resin problem, or to discuss the possible advantage of using resins in any operation or process. Write Interlake Chemical Corporation, Plastics Division, 1935 Union Commerce Building, Cleveland 14, Ohio.

Interlake will supply a specification resin for applications involving the coating, impregnating, or bonding of WOOD • PAPER METAL • GLASS • FIBRE • CELLULOSE • RUBBER

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Corporation
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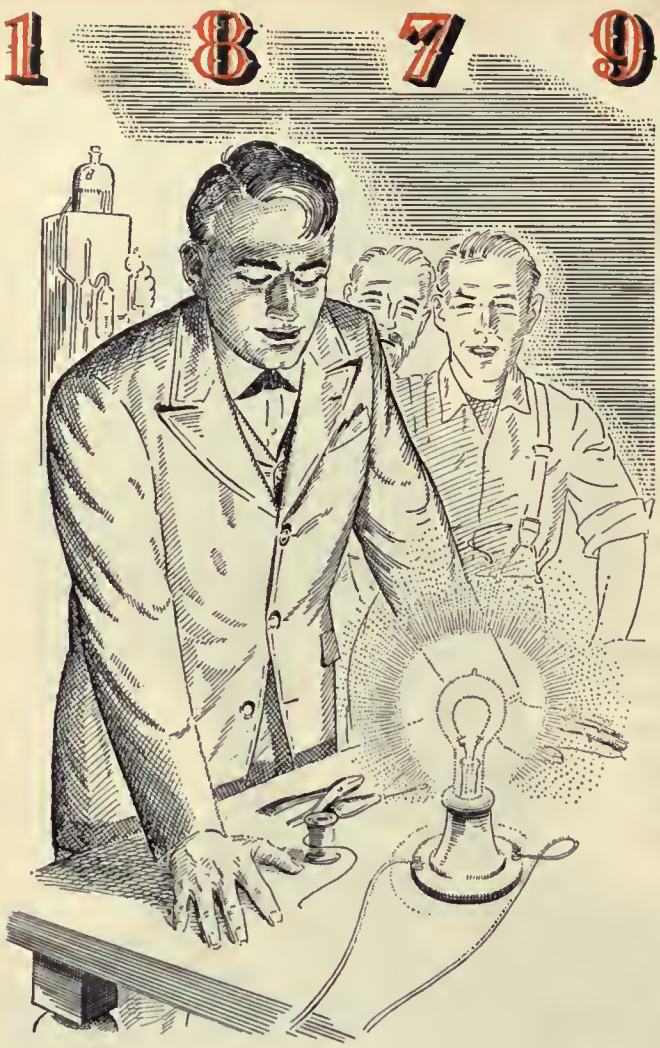
Specificity IN RESINS



The Lamp that Lit the World . . .

When Thomas Edison subdivided the electric current to make carbonized cotton thread glow in a vacuum, the incandescent bulb was born. That was in 1879, when the Auburn Button Works was *already* three years old.

Since then, the use of molded plastics parts has permitted new advances in electrical science. Today, Auburn's 70 years' experience in molding these plastics parts is still working for the electrical industry, as it is for all types of American industry.

For small parts molded automatically at low cost, write: Woodruff Company, Division of Auburn Button Works, Inc., Auburn, New York

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AUBURN ENGINEERED PLASTICS

All Types of Molding Complete Mold Shop
Extruded Tubes and Shapes

AUBURN BUTTON WORKS
INCORPORATED

MOLDERS SINCE 1876 AUBURN, NEW YORK

chloride, vinyl chloride-acetate, other vinyl chloride copolymers, polyvinyl butyral and polyvinyl acetate available in resin form. For certain types, there was a tenfold expansion during the emergency. The ending of the war, delays in reconversion of customers' operations, need for new processing facilities, and labor difficulties in customers' plants, particularly in the automotive and consumers goods fields, have somewhat lessened the demand for these resins.

Polyvinyl Butyral Sheet

Present demand is abnormally low due to strikes. There appears to be sufficient capacity to meet normal demands.

Vinylidene Chloride Resins and Plastics

Substantial increases in capacity over 1944 have already been effected, and it is anticipated that this plastics will be available in quantities approximately double the 1944 rate during the early part of 1946. In the early part of 1947, the volume of production will be about 450 percent of the 1944 rate.

Cellulose Nitrate Sheet, Rod, Tube

Producers report capacity operations, with shortage of labor causing difficulty in some cases. Demand is somewhat in excess of present supply. Flake production is now 50 percent over that of 1944, and a slight increase in capacity is anticipated early in 1947.

Cellulose Acetate Sheet, Rod, Tube

Producers are running at capacity, but in some cases shortage of flake is restricting operations. There is no forecast for increased production of film during the first quarter of 1946. However, customers can anticipate increased availability of continuous sheeting during the latter part of 1946 and through July, 1947, amounting to roughly 66 percent increase over the present rate.

Adhesives, Laminating and Specialty Materials

There has been a marked drop in the demand for urea and melamine resins for adhesives, and production facilities appear to be ample to meet present demands. In some cases, the spray dried urea resins are running at capacity, and there will be additional availability come into operation during the first quarter of 1946.

There is no problem with respect to laminating materials availability at the present time, except in those instances where labor shortages materially restrict the amount of production.

Cast phenolics for certain end uses, such as radio cabinets, are being produced at capacity. The demand so exceeds the supply that orders are two and three months in arrears. A moderate expansion in cast resin facilities can be anticipated.

Customers' requirements for the various phenolic liquid resins for such special purposes as laminating, abrasives, cork insulations and glass wool, are being filled without too much difficulty at the present time.

Methyl Methacrylate Cast Sheet

The supply of cast sheet exceeds the demand, and all customers' requirements are being filled with reasonable promptness.

Summary

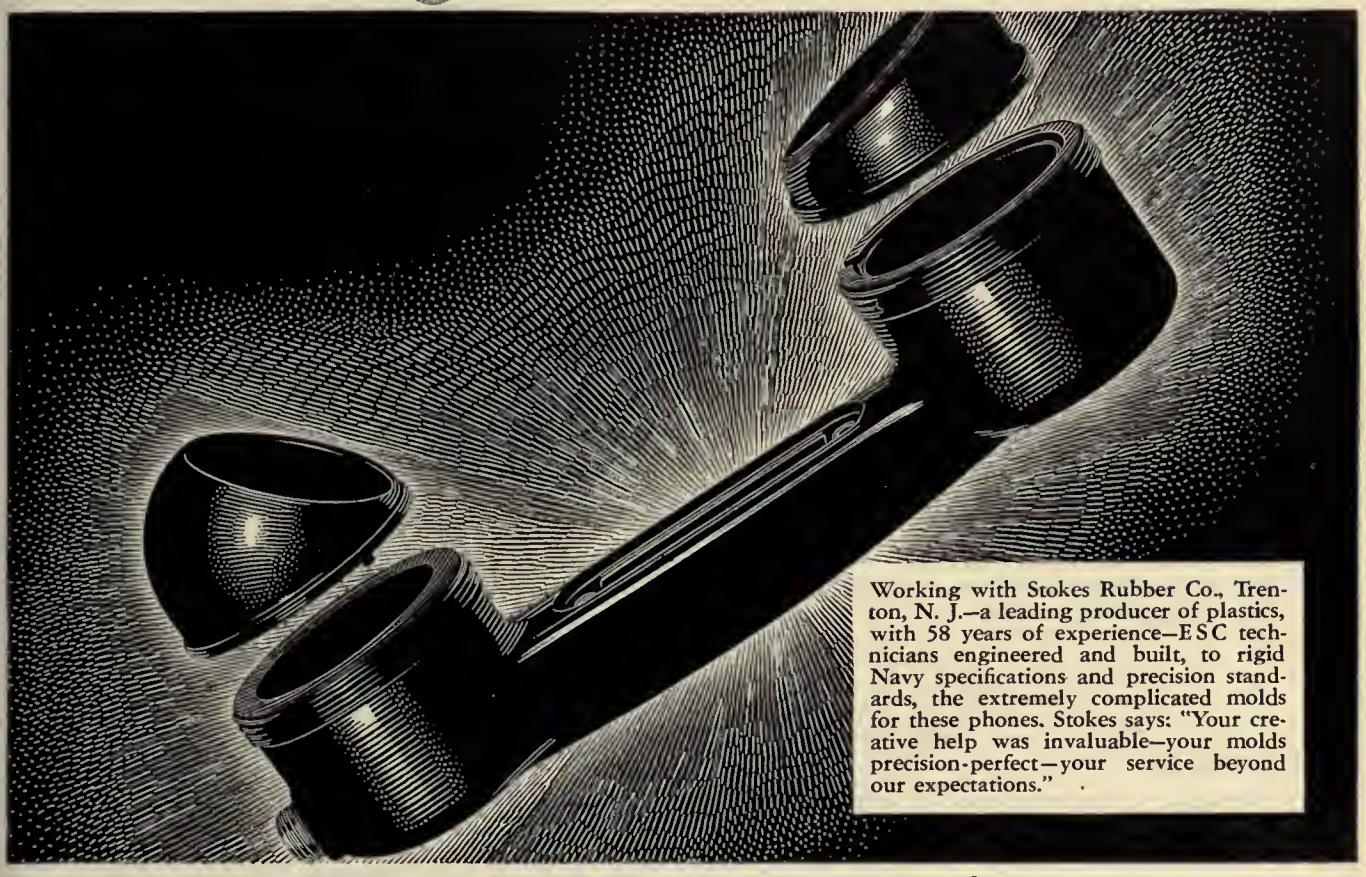
With but few exceptions, the demands for plastics materials greatly exceed the supply at this time. There has been considerable discussion as to the amount of inflation in orders now in the hands of the manufacturers. It is evident that some measure of relief will become effective during the first quarter of 1946 and will continue thereafter

(*Continued on page* 123)

Battle Talk signs off!

● Joyous V-J Day news was strange talk to be coming over "intercom" phones aboard Uncle Sam's battle-wagons! Vital cogs in ship-wide communication systems during combat, these instruments are not just ordinary telephones. They are *sound-powered,* operate independent of the ship's electrical wiring, and are intricate in construction. They must work *right,* in battle. *And they did.*

Now their wartime mission is accomplished—and so is ours, in supplying many of the molds for their production.



Working with Stokes Rubber Co., Trenton, N. J.—a leading producer of plastics, with 58 years of experience—E S C technicians engineered and built, to rigid Navy specifications and precision standards, the extremely complicated molds for these phones. Stokes says: "Your creative help was invaluable—your molds precision-perfect—your service beyond our expectations."

Now let's talk BUSINESS!

IF YOU'RE IN the market for plastic molds, here are three reasons why you'll find E S C an experienced, capable and dependable firm to do business with:

1. Even before the war, our staff of experts were nationally known authorities on plastic molds and molding. Added to this is the experience gained during wartime in designing and making highly intricate types of molds, such as those for the vital, sound-powered Navy phone above.

2. Among E S C customers are many of the most prominent molders in the country, for whom we have designed, engineered and produced a wide variety of precision-built plastic molds. References will be furnished on request.

3. E S C facilities have been expanded to meet peacetime demands. New equipment of the most modern design has been added. You are assured of prompt delivery on any type of mold you may require.

We're prepared to work with you from the design stage right on through to the finished product. Your inquiry is invited. Why not write, wire or phone today?

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Program of SPE Annual Meeting

Rackham Memorial Building, Detroit, January 7-9

PLANS have been completed for the Plastics Exhibit of the Society of Plastics Engineers—the first major post-war plastics show—to be held in Detroit's Convention Hall from Monday, January 7, through Friday, January 11, 1946. The Plastics Exhibit was postponed from the planned date in 1945 in order to avoid any interference with heavy war-time transportation demands. The SPE show will be the largest ever held, according to Fred Conley, Publicity Committee Chairman for the Exhibit. "The floor plans show a greater area of exhibit space than ever before allocated to this type of industrial show," he said. "For the first time," Mr. Conley continued, "the SPE Plastics Exhibit, as it will be known in industry, will be a forthright effort on the part of exhibitors to sell their products."

The Society of Plastics Engineers Annual Meeting, also scheduled in conjunction with the Exhibit, will be held in the East Wing of the Horace H. Rackham Educational Memorial, 100 Farnsworth Avenue, on January 7, 8, and 9. Technical sessions sponsored by the Professional Activity Groups of the Society will convene daily. Featuring the three-day technical program will be a series of educational courses consisting of lectures for both morning and afternoon sessions. Subjects will include materials, molding techniques, product design, laminates, tool design, coatings, and consumer specifications. A detailed program listing the speakers and their subjects is given below.

New national officers will be installed and reports presented at the annual business meeting on January 8. The annual banquet will be held on the same date, for which Russell Barnes, feature writer for the Detroit *News*, will be the speaker.

Other associations and industrial groups will also convene in Detroit during the week of the plastics exhibit, including the Society of Automotive Engineers. END

PROGRAM

Monday, January 7, 1946

9:00 A. M. Registration

10:00 A. M. Business Meeting — Steering Council, National Group Chairmen

RECESS FOR LUNCH

1:30 P. M. Greetings by National Chairman "Outline Scope of Activities" J. A. Mickey, Ford Motor Co.

Technical Sessions

I—MATERIALS

Chairman—B. E. Cash, Celanese Corp. of America

Dr. S. D. Douglas, Carbide & Carbon Chem. Corp.: "New Plastic Developments During the War in the U. S. A."

Alexander Nixon, Fisher Body Division, General Motors: "Plastic Materials in Automotive Construction"

Dr. H. A. Winkelman, Dryden Rubber Co.: "Plastics in the Rubber Industry"

II—MOLDING TECHNIQUE

Chairman—J. C. Kazimier, Amos Molded Plastics

W. Goggin, Dow Chemical Co.: "German Plastic Fabrication Methods"

A. P. Mazzucchelli, Bakelite Corp.: "High Frequency Heating"

W. S. Prendergast, Carter Products Corp.: "Special Extrusion Molding"

Tuesday, January 8, 1946

9:00 A. M. Registration

9:30 A. M. Technical Sessions

III—LAMINATES SYMPOSIUM

Chairman—Harry Kline, Reichhold Chemicals Corp.

Simon Williams and E. V. Painter, National Cotton Council: "Cotton in Relation to Laminates"

C. F. Marschner, Forest Products Lab.: "Semi-Structural Fabrications"

G. Slayter, Owens-Corning Fiberglas Corp.: "Engineering Properties of Fiberglas Reinforced Plastics"

RECESS FOR LUNCH

1:30 P. M.

Dr. Harry F. Lewis, Institute of Paper Chemistry: Subject to be announced

Dr. Gordon Kline, National Bureau of Standards: "Developments in Plastics in Germany During the War"

L. C. Chesley, American Cyanamid Co.: "Decorative Laminates"

T. Walter Noble, Fabricon Products, Inc.: "Low Pressure Molding—Materials and Technique"

Dr. E. R. Perry, Westinghouse Electric Corporation: "Resin and Raw Material Requirements from a Laminator's Standpoint"

R. J. Metzler, Hercules Powder Co.: "Thermoplastic Laminates"

6:30 P. M. Annual SPE Banquet (Wardell Sheraton Hotel)

Speaker: Russell Barnes, Feature Writer, Detroit News

Wednesday, January 9, 1946

9:00 A. M. Registration

9:30 A. M. Technical Sessions

IV—TOOL DESIGN

Chairman—R. G. Dailey, Standard Products Co.

B. F. Hantz, American Insulator Co.: "Compression and Transfer Molds"

W. W. Broughton, National Lead Co.: "Kirksite Plastic Molding Tools"

Clinton Rector, Catalin Corp.: "Tooling Aspects of Cast Plastics"

V—COATINGS

Chairman—J. R. Turnbull, Monsanto Chemical Co.

P. F. Corbin, Textileather Corp.: "Plastics as Coatings"

David S. Plumb, Monsanto Chemical Co.: "Polyvinyl Butyral Coatings"

RECESS FOR LUNCH

VI—CONSUMER SPECIFICATIONS

Chairman—R. Chollar, National Cash Register Co.

G. F. Clark, Owens-Illinois Glass Co.: "Consumer Specifications and Their Applications"

N. Rakas, Chrysler Corp.: "Industrial Aspects of Consumer Specifications"

F. A. Martin, The Hoover Co.: "Stability of Phenol Formaldehyde Plastics"

VII—PRODUCT DESIGN

Chairman—J. A. Hill, Barnes & Reinecke

Dr. Heindrich Bulchdorf, Barnes & Reinecke: "Products of the Future"

William L. Hess, Midwest Plastic Prod. Co.: "Product Design from a Molder's Viewpoint"

John Sasso, Managing Editor, *Product Engineering:* "What Design Engineers Expect of the P.A.C."

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CHARACTERISTICS . . .

These general properties are available either in standard or special formulations subject to design and method of fabrication.

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Small or large—simple or intricate castings.

Castable in the following molds: Plaster, Rubber, Gelatin, Wax, Sample parts or models as required.

Formrite is applicable in all manufacturing industries. We can show you how Formrite can fit in to your manufacturing requirements.

As a binding or bonding material with various fillers.

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Laboratories are available for the development of your experimental or production problems utilizing our diversified experience in design, sculpture, art work, preparation and reproduction of original models, plaster work, tooling techniques, mold making, substitution of materials, product and process development . . . For Industrial, Scientific and Commercial items . . . Problems on unusual and difficult jobs are our specialty.

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STAFF OF 181 TWELFTH YEAR

association activities

German Plastics Discussed at SPI Meeting

Two talks on German plastics were given at the dinner meeting of the New York chapter of the Society of the Plastics Industry held at the Hotel Roosevelt, New York, December 4.

John M. DeBell, one of the members of the plastics team assigned to making a survey of the progress made by the German industry since that country was "blacked out," spoke on the subject of German advance in plastics materials and products, while Capt. George Nalle, a liaison officer for the team, concentrated on the German injection molding industry. He emphasized the fact that most of the German injection molding machines were of very small capacity, and that only two machines of about 16-oz. capacity were to be found in the entire German industry.

ASTE Exposition Scheduled

Announcement was made by the board of directors of the American Society of Tool Engineers, at its semi-annual meeting in Detroit, that the organization plans its Exposition for April 8 to 12, inclusive, at Cleveland. Arrangements have been made for the use of the entire Cleveland Public Auditorium, which will encompass 250,000 sq ft of space.

This is to be the fifth such exhibit of production equipment and processes held by the Society, and is being designed with major attention to its educational and informational value for all engaged in the field of production. Not only machines and tools, but all possible types of materials handling equipment, materials for fabrication, control devices of hydraulic, electrical, and electronic design, and a variety of other devices are to be included in the exhibit, according to present plans.

Comprehensive and detailed plans for the event are nearing completion, it is announced, and the Society has decided on the name of "New Era" Exposition, feeling that this show really ushers in a new era of postwar industrial progress.

A series of technical sessions has been scheduled for the annual ASTE meeting, which is to be held concurrently with the Exposition, and G. V. Briner, the organization's president, has expressed the opinion that the exhibition, and the accompanying sessions, have a very definite mission in their bearing on the plans of industry for peacetime pursuits and civilian production requirements.

Packaging Institute Meeting

At the seventh annual meeting of the Packaging Institute, held on November 26 and 27 at the Hotel Commodore, New York, a number of talks were delivered, among them being several of particular interest to the plastics industry. These included: An address titled "Plastics Packaging," by Major E. L. Hobson, Plastics & Packaging, Office of Quartermaster General, Washington, D. C.; "Adhesives" formed the subject of a talk by F. P. Bartlett, Jr. sales engineer in charge of specialties, Union Paste Co., Hyde Park, Mass.; W. H. Gracbner, of the Marathon Corp., Menasha, Wis., spoke on "Coated Papers and Implications Thereof;" and an address by Capt. W. H. Aiken, office of Quartermaster General, Washington, D. C., dealt with the topic of "Transparent Films."

Officers re-elected for another annual term were Walton D. Lynch, president; W. O. Brewer, manager pharmaceutical sales, Calco Chemical Div. of American Cyanamid Co., and George A. Mohlman, president of Package Machinery Co., were both re-elected vice presidents. Major Albin Dearing, Eccleston, Md., was named executive head of the Institute.

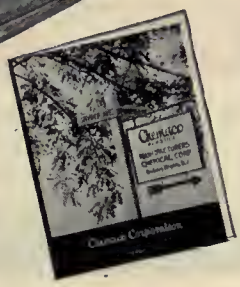
Plans for an international packaging exposition scheduled to be held in New York City in connection with "National Packaging Week," were also inaugurated at the annual meeting.

An Accessory to Styling

BAG FRAMES BY FRANKLIN PLASTICS

Chemaco Cellulose Acetate and Polystyrene are high fashion news for accessories. Their ease of moldability, range of colors and brilliant crystal, sturdy, long-wearing qualities and beautiful textures make them a natural choice of materials for **mass production** of smart feminine accessories. Streamlined cigarette cases, handsome purse frames, smart compacts, jewelry cases and dainty dressing table fittings are molded from Chemaco plastics.

Chemaco also makes Ethyl Cellulose and Vinyl Compounds. Chemaco engineers will help you in choosing the correct plastic for your needs.



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Bronch Office—Cleveland, O.

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Are you planning a molded plastic part for your product? If you are, please bear this fact in mind . . . *the most important matter you have to consider is your choice of custom molder.*

Because . . . he will be wholly responsible for a vital part of your product . . . for solving engineering problems . . . designing and building the molds . . . running the job . . . finishing each piece . . . and feeding it into your production lines as your schedule demands. The very success of your product may hinge upon his engineering and production ability.

Therefore, before you make your decision you'll find it well worth while to get the answers to these questions:

1. Has he a long record of successful and dependable service in the field?
2. Does he provide a complete service, assuming undivided responsibility for designing, mold-making, molding and finishing?
3. Are these services within his own organization—coordinated under a single engineering and operating group?
4. Can he provide the method best suited to your job, whether it be compression or injection molding?
5. Has he the correct size and type of press to handle your job most efficiently and economically?
6. Does he have a reputation for doing even the toughest jobs well?

If he can answer all of these questions in the affirmative, you're safe. Give him the job.

If you'd like *our* answers to those six questions, you'll find them in this new book, and it's brim full of valuable information . . . facts and figures important to any buyer of molded plastics . . . fully illustrated with photographs, charts, and drawings. Write for your free copy today . . . on your firm letterhead, please.

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WHAT'S *New* IN PLASTICS

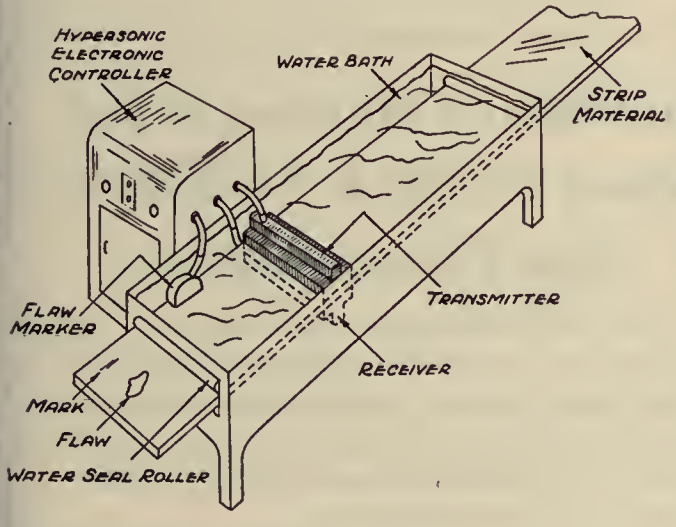
Flaw Detector

Brush Development Co.
Cleveland, O.

A new device called the *Hypersonic Analyzer,* based on the use of sound waves of a frequency inaudible to the human ear, promises, on the basis of performance to date, to set new standards of production speed and efficiency in detecting flaws in plastics sheets, extruded plastics, and plastics laminates, as well as in aluminum, phosphor bronze, berylium copper, brass, and other metals and alloys.

Although the *Hypersonic Analyzer* can detect any change in density of a wide variety of materials and thus has many possible uses, immediately it is thought to offer greater possibilities to the metals and plastics fields than to any others. In the rolling of sheet steel, for example, the *Analyzer* will accurately detect and identify the location of such defects as "pipes," "cat's eyes," "blisters," and "laminations."

The new machine consists essentially of three parts: (1) a Piezoelectric crystal transmitter, (2) a Piezoelectric crystal receiver, and (3) a signalling or marking device. The crystal transmitter sends supersonic waves through the material being examined. These waves are picked up by the crystal receiver,



and a constant result is registered until defects or a definite change in density is encountered. The actual detection and identification of a flaw may be indicated on a meter, by a signal light or bell, or by a relay hook-up for making desired physical markings.

The *Hypersonic* method detects flaws associated with two physical properties of the material: a change in density and a change in the modulus of elasticity. Because the new device is sensitive to changes in the modulus of elasticity, it can be used to examine for such flaws as thin slits or cracks in the material. In defects of this type, the change in total mass is negligible, but at the separation junction the effective modulus is obviously small since the material is already separated.

This method of detecting separations is believed by Brush engineers to be ideal for testing plastics laminates, such as glass cloth-resin and organic fabric-resin combinations, for poor bonding between the reinforcement and the resin. Experiments with a laminate composed of two *Lucite* sheets bonded by a glue show that the sonic method can search out very minute separations not in the slightest indicated in an X-ray picture of the laminate .....(446)

Tap Screws

Continental Screw Co.
New Bedford, Mass.

Described as combining the actual cutting action of a tap with the economy of a screw, this *Holtite* Tap Screw is provided with two balanced cutting edges and a chip reservoir by means of a patented slot in end of the screw, which corresponds to the flutes of a tap. In action, the curled chips cut from material are pushed ahead of the screw in the same manner as chips are pushed ahead of a spiral pointed tap. The full slot is said to permit easy chip clearance, eliminating binding and reducing driving torque and effort.

Not intended to replace the sheet metal screw in normal applications, according to its makers, the *Holtite* Tap Screw, it is said, can be used in various applications where certain factors may have made it impossible to use sheet metal screws. It is described as being ideal for use in plastics, cutting deep, smooth, clean threads without chipping material around edge of hole, or bulging the hole perimeter upwards in the case of laminated plastics .....(447)

Steam Platen Press

R. D. Wood Co.
Philadelphia, Pa.

Designed for laminating, curing and polishing plastics sheets to uniform thickness and surface finish, this 10-opening 2700-ton steam platen press, with elevator, incorporates, as part of both press and elevator, quick loading and unloading mechanism which permits moving material in and out of press without sliding over or in any way contacting the polished platen surfaces, thus eliminating scratching or scoring of the highly finished platens.

The press, available for operation on a 2-pressure accumulator

To simplify for our readers the task of obtaining detailed information regarding the new products, processes and trade literature described herein, *plastics* offers the prepaid postcard inserted here.

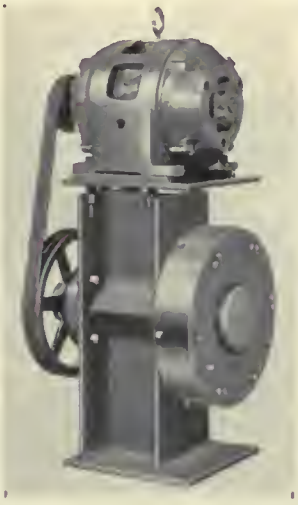
In rapidly-moving times such as these, keeping up with every latest development in one's field is a "must." Facilitation of reconversion, speeded production, and the competitive drive toward lower manufacturing costs require that all avenues leading to a solution of these problems be explored thoroughly.

Each item in this section is keyed with a number, which should be entered on the postcard, to expedite identifying the exact product, process or publication about which information is desired.

system, using 300 psi accumulator pressure for rapidly closing the press and 4400 psi for the pressing and holding stroke, with elevator operated from the 300 psi line, can also be furnished as a completely self-contained unit and in capacities up to 7500 tons, with steam or electric heated platens as required.... (448)

High Pressure Booster Pump

Martin Wells
Los Angeles, Calif.



Described as providing dependable and continuous service with high pressure oil-operated machines, such as presses for plastics, rubber, drawing, bending, etc., this high pressure booster pump, announced as now available, is said to solve the problem of too much "down-time" for repairs.

Continuous trouble-free performance at pressures up to 5000 psi, with complete reliability, is claimed for this item, with frequent repairs eliminated by its simplicity, strength and precision fit.

Other features include little space requirements for installation, and compact construction. The pump is available in sizes up to 24 qts. ..... (449)

High-Speed Lathe

R. K. LeBlond Machine Tool Co.
Cincinnati, O.

Specially designed for use where exceptionally high speed and short cycle machining are required, the *Le Blond* 13" Motor Head Rapid Production Lathe picks up full speed in 2 sec, stops in 2½ sec, according to its description.

Among other features listed by its makers for this item are: New type motor head in which a multi-speed armature is mounted on the spindle; rigid construction of head, enabling operator to bring speed up to 3600 rpm and stop the spindle 5 times per min; full control of machine maintained by operator at all times, from push-button control station mounted at top of machine.

The 5 hp, 4-speed motor, which operates at 1800 rpm for its rated output, gives 3⅓, 2½, and 1⅔ hp for 1200, 900, and 600 rpm, respectively ..... (450)

Roller Coating Service

The Japan Co.
Cleveland, O.

A new roller-coating process by means of which many plastics, metal and wood products can be finished before stamping, forming or other fabricating; combining a specially-designed coating machine with carefully-engineered infra red baking equipment, according to description, this method is said to produce roller-coated sheets completely baked in 3 min or less.

The process was developed especially for the use of vinyl base materials, although various types of finishes are employed in addition to plastics coatings, all types being applied with great uniformity of thickness, it is claimed, tolerances as close as .001" being held to customers' specifications, and uniform color shades, including delicate pastels, being easily maintained..... (451)

You Hold a Winning Hand When KUHN & JACOB Is Your Plastic Molder

The K & J trade mark on the plastic part of a product is a sure sign of its unfailing quality. This plastic part has been designed and molded to meet the particular conditions for which it was intended. Within these bounds it will give complete and lasting satisfaction.

It will pay you to confer with us, and determine just what conditions YOUR piece will encounter.

ESTABLISHED 1919 K TRADE MARK

KUHN & JACOB MOLDING & TOOL CO.

1200 SOUTHARD STREET, TRENTON 8, N. J.
TELEPHONE TRENTON 5391

Plastic Molding

Sales Representatives: NEW YORK—S. C. Ullmann, 56 W. 42nd St. PHILADELPHIA—Towle & Son Co., 18 W. Chelton Ave. Bldg.
NEW ENGLAND—Wm. T. Wyler, 177 State St., Bridgeport, Conn.

Literature Review

Information for Industrial Designers

The B. F. Goodrich Co.
Akron, O.

Newly-published 12-page booklet, designated as a "Guide Book for Industrial Designers," suggesting applications for various products of the company.

The opening pages are devoted to *Koroseal,* outlining in detail this material's physical and chemical properties and listing a number of its industrial and commercial uses.

Other of the company's products which are of interest to developers of equipment used by industry are outlined, and their outstanding features and uses listed.

Compactly arranged and illustrated, the booklet is planned to supply comprehensive information quickly and clearly.... (452)

Convenient Reference Folder

McInerney Plastics Co.
Grand Rapids, Mich.

4-page letterhead and chart identifying the physical, chemical and electrical properties of plastics material available through the company, contained in a sturdy and easily identifiable file-size folder titled "Plastics Products."

Folder and letterhead enclosure are photographically illustrated and text matter concisely arranged for ready reference ..... (453)

Power Tool Catalog

Boice-Crane Co.
Toledo, O.

A 48-page catalog (*No. 45*) in which are listed, illustrated, and described the line of power tools made by the company for use on plastics, metals, or wood.

Diagrammatic drawings, specifications, and performance data are included ..... (454)

Resin Colloid Developments

American Resinous Chemicals Corp.
Peabody, Mass.

Prepared especially to present the developments of the past few years in uses of resin colloids, this booklet provides, in compact form, discussion of the theory of emulsions, dispersions, and solutions; brief descriptions of several applications; information on shipping and handling of emulsions and dispersions, and specific information regarding the various available resin colloids.

There are also descriptive tables of products, giving their respective properties, characteristics, and a compilation of known industrial uses and of reference from trade and patent literature, as well as of the company's own practical experience.... (455)

Custom Molding Service

Watertown Mfg. Co.
Watertown, Conn.

Catalog titled, "The Watertown Book of Plastics," telling the story of the company's equipment and facilities for complete custom service in plastics molding, from designing through finishing, including testing of finished parts for perfection.

Materials, molding methods, buffing, finishing, assembly, engineering, etc., are discussed; the company's new laboratory is described, and there are several pages on stock molds, as well as on custom molds. Photographic illustration is well distributed throughout this 44-page catalog, and technical data and charts complete the contents..... (456)

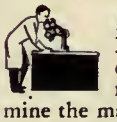
Thermoplastic Compounds

Resin Industries
Santa Barbara, Calif.

An informative booklet on the company's line of *Resinite* tapes, tubing, and tying cords, listing characteristics and features

For every purpose--
TO YOUR SPECIFICATIONS

For over forty years we have been leaders in the design and manufacture of component parts for leading Refrigerator, Stove, Furniture, Appliance and Cabinet industries. We specialize in custom molding by the injection, compression or transfer method in any thermosetting or thermoplastic material. A complete service from one source to serve your needs — at no extra cost.



RESEARCH — Highly experienced research engineers to determine the material best suited for your needs as to strength, utility and beauty.

DESIGN — A thorough study is made as to the utility, shape and color of the plastic part that will best harmonize with the style and design of your product.

ENGINEERING— Here is where the correct tools, precision dies and molds are developed to produce the best job, efficiently and economically.

TOOL AND MOLD MAKING — This department, manned by expert craftsmen, makes the necessary tools and molds to produce the finished product.

MOLDING — A complete department equipped with the latest and most modern presses and molding equipment — for Injection, Compression or Transfer molding.

INSPECTION AND SHIPPING Each individual piece is carefully inspected for uniformity, color and finish. All parts are carefully wrapped and packed for utmost protection.

If you are planning the use of plastic parts in your products, it will be advantageous for you to investigate our complete service. Write or phone us about your needs.

NATIONAL LOCK COMPANY
Plastics Division
ROCKFORD, ILLINOIS

An Ideal, Economical and Accurate Production Tool for the

PLASTIC and JEWELRY TRADES

$200.00
F. O. B.,
New York
Prompt
Shipment

THE NEW IMPROVED

KNUCKLE-ACTION FOOT PRESS

A Practical Press, Easy to Operate, that will Save Time and Labor in Forming, Blanking and any other work where pressure is required.
Ideal for Die-Cutting Lucite.
Constructed to do the work of a Power Press.

Specifications for Knuckle-Action Foot Press

Size of bed	12"x18"
Size of opening between uprights	12½"
Size of hole in press head	2"
Maximum stroke	2"
Maximum shut height	8"
Minimum shut height	4"
Adjustment screw	2"
Weight of press	344 lbs.

Manufactured by

CELOID MFG. CO., INC.

893 Broadway, New York 12, N. Y., Tel. GRamercy 7-1850

of each. Fabricated from thermoplastic synthetic resin compounds, in which the company specializes, these products are produced in a wide variety of sizes, shapes and colors suited to the requirements of specific applications.

Properties, dimensions, and specifications of these products are included in the booklet.....(457)

"Plasticizers & Chemicals"

Ohio-Apex, Inc.
Nitro, W. Va.

30-page booklet devoted to specifications, properties, characteristics, and other information about the chemicals and plasticizers produced by the company.

There is a section of helpful tables and charts, and recommended proportions for various formulas. A complete index facilitates quick reference.....(458)

Fine Pitch Gear Finisher Bulletin

Michigan Tool Co.
Detroit, Mich.

A 4-page bulletin (*No. 861-4B-45*) describing the company's latest model *861-4B* fine pitch rotary gear finisher, designed specifically for the rapid finishing of small gears to extremely close tolerances by the crossed-axis principle of gear shaving.

Gears of 16 to 64 pitch and even higher, ranging from ¼" to 4" in diam, and up to 1" in face width, can all be finished on this machine, according to description.

Particularly suited to producing fine pitch gears used in instruments, control mechanisms, and other high precision devices, the item is described in detail in the new bulletin, which includes complete machine specifications, together with other essential data .....(459)

Plastics Fabrication

Sillcocks-Miller Co.
So. Orange, N. J.

Concisely-designed brochure presenting outline of the company's facilities for fabrication of plastics materials for commercial, technical and industrial requirements. Items produced by the company are pictured, and brief description of the services which it is prepared to offer are listed.....(460)

Dynamometer Booklet

W. C. Dillon & Co., Inc.
Chicago, Ill.

An informative booklet providing data concerning the *Dillon Dynamometer*, its uses, possibilities of application, details of construction, etc.

Photographic illustrations throughout the booklet show typical applications of the *Dynamometer*, and the various models are pictured, shown in use in various applications. Capacities and prices are listed, and the capabilities of the apparatus described .....(461)

Bulletin on Custom Molding

Imperial Molded Products Corp.
Chicago, Ill.

Information on facilities, from engineering to finishing, offered by the company in the field of custom molding. Photographic views of several departments, of typical specimens of items custom molded, and a number of those which can be supplied from stock molds, by the organization, serve to illustrate the folder; brief text descriptions of phases of the services available, and a table of characteristics of compression molded plastics, are included in this bulletin, *No. K-200*.....(462)

Vibration Test Equipment

L. A. B. Corp.
Summit, N. J.

Literature on vibration testing by means of the company's equipment especially designed for use in laboratory and production for determining vibration resistance of various products.

By shaking out faults, without protracted field tests, vibration testing is described as a means of expediting new design; all products being "subject to destructive vibration forces either during shipment or in service".....(463)

GREAT and rapid strides have been made in adapting America's industrial might to peacetime requirements . . . new processes, new production equipment. Soon these great achievements will be revealed . . . in the largest industrial exposition of its kind. This first postwar ASTE exposition will open the door to *New Era* engineering and manufacturing, with every person among the more than 100,000 in attendance having a vital interest in what's new. **This is industry's show for industry!**

Here will be shown the many new designs and engineering projects on which America's new peacetime industry must be built! Manufacturers and industrial engineers will exhibit their latest developments.

The country's leading tool engineers will be there, to attend the Annual Convention of the American Society of Tool Engineers. It is the major postwar opportunity for manufacturers to exhibit their products to all industrial America.

WHERE Public Auditorium Cleveland, Ohio

WHEN April 8-12 1946

WHO Leading Manufacturers and Industrial Engineers

WHY To Exhibit *New Era* Production Equipment and Processes

For full information write to

AMERICAN SOCIETY OF TOOL ENGINEERS

Exposition Committee

1666 PENOBSCOT BUILDING ☆ DETROIT 26 ☆ MICH.

PLASTICS
are in the Air
...but
our feet
are on the ground
● Everybody wants plastics for their products these days though in some cases it may be neither practical nor profitable.
As reputable plastics molders of proven, time-tested standing, we pride ourselves on 3 things:
1. Our ability to guide and counsel you on all plastics molding matters.
2. Our insistence upon being honest and aboveboard in thinking first of your product relative to plastic application.
3. Our ability—through skilled technicians, experienced engineers, style designers, and other highly specialized equipment and personnel —to give you the best job possible.
Send in your blue prints or sample product NOW for an early and accurate appraisal.
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CONTINENTAL
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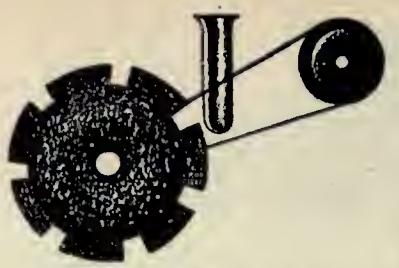
308 WEST ERIE STREET
CHICAGO 10, ILL.



PROBLEMS in *plastics*

Problems and questions may be submitted to this department for answering by the technical editors or specialists in the industry.

I am a manufacturer of clothes closet appliances. For one part of my equipment I have used maple poles, two common sizes being ½" by 6' and ⅞" by 6'. These poles have to be drilled on 6" centers and have clips riveted to them. When rigidly held at the ends, they must withstand considerable side thrust and the clips must not dig into them under reasonable pressure.

I understand that a process has been discovered whereby soft wood such as spruce or pine could be impregnated with a plastics so as to make it as hard as maple. I should appreciate the names of companies who can inform me about this process.

P.S.M., Oakland, Calif.

We suggest you present your problem to the company which originated the process you refer to—E. I. du Pont de Nemours & Co., Plastics Div., 626 Schuyler Ave., Arlington, N. J.

* * *

Will you please refer me to published material on mold design.

W.A.P., Milwaukee, Wis.

A good source of information on mold design is the "Handbook of Plastics" by Simonds and Ellis, published by D. Van Nostrand Co., Inc., 250 Fourth Ave., New York, N. Y.

* * *

I am in search of a manufacturer or dealer who handles plastics playing cards. Any information you can give me will be greatly appreciated.

R.G., Memphis, Tenn.

Kem Plastics Playing Cards, Inc., 330 W. 42nd St., New York, N. Y., are manufacturers of plastics playing cards.

* * *

We have not been able to preheat molding tablets uniformly in our electronic oven. In some cases, even a single tablet is heated unevenly. Molded articles made of such a tablet and removed from the mold before they are completely cured, often contain specks of material which were apparently cured before the tablet was ever inserted in the mold. Your comments will be appreciated.

I.S.A.C., Monterrey, Mexico

We are sorry that we are unable to give you a definite solution to your problem, without knowing more about the materials you are using and the type of oven you have. Your molding material may not be uniform in composition, thus causing uneven heating, and we advise that you write to your materials supplier about your difficulty. If the powder checks satisfactorily, then perhaps the fault lies with the electronic heater.

* * *

What plastics would make a suitable binder for sawdust which can be used as a basis for making molded toys which can be satisfactorily sawed or cut? Also, what kind of sawdust should be used in connection with the applicable plastics binder?

H.L.B., Madison, Ind.

We believe that any fine sawdust will answer your purpose. For a binder, the easiest-to-handle plastics and the cheapest would be a water-soluble phenol-formaldehyde plastics.

* * *

Where can we obtain plastics cigar and cigarette holders?

E.D., Toronto, Ont.

Plastics cigar and cigarette holders are manufactured by H. Jamison Co., 71 E. Sunrise Highway, Freeport, L. I., N. Y.

INDUSTRY HIGHLIGHTS

Two new plasticizing resins for use in metal, wood, fabric and paper coatings and with plastics and wax compositions have recently been announced by The Dow Chemical Co., Midland, Mich.

The first of a new series of styrene resins to be produced by the company's laboratories, these products have been designated as *276-V2* and *276-V9,* respectively.

Described as water-white, non-yellowing viscous liquids which are chemically inert, are soluble in all common organic solvents except the lower alcohols, and compatible with a wide variety of film-formers and plasticizers, the workability of these new resins with waxes, and their resistance to alkali, were stressed as factors greatly expanding their range of use.

An extensive program for peacetime expansion has been launched by Athol Mfg. Co., Athol, Mass., with the creation of a new sales promotion department under the managership of Thomas P. Milligan, vice-president in charge of bookbinding sales.

The new department, it is announced, will concentrate on product development and promotion of the company's *Terson* vinyl resin coated fabrics for end uses requiring strong resistance to abrasion, cracking, and extreme weather conditions. It will also co-ordinate all of the new lines currently being introduced by the company, with special attention to market applications that will utilize the added qualities which have resulted from wartime research.

An 18-story office building, which will add approximately 240,000 sq ft of usable floor space to the Nemours Bldg., Wilmington, Del., is planned by E. I. du Pont de Nemours & Co. It is to be modern in every detail, and will replace the Nemours Bldg. Annex, which is being razed to make way for the new project. Construction is scheduled to start next Spring.

Resin Industries, Santa Barbara, Calif., has announced the appointment of Northwest Plastics Industries, 4th & Cherry Bldg., Seattle, as its authorized representative in the states of Washington, Idaho, and Montana.

Involving large plastics resin manufacturing units and other buildings adjacent to the company's *Plaskon* research laboratory in Toledo, O., a huge construction program is planned for the *Plaskon* Division of Libbey-Owens-Ford Glass Co., according to recent announcement by John D. Biggers, president.

The buildings are to include multi-storied manufacturing facilities for resin and molding powder and experimental and pilot plant facilities.

The company hopes for completion of the pilot plant by early Spring and the resin manufacturing plant by late July, with the balance of the project's completion dependent upon availability of material. Plans also include doubling the size of the present research laboratory.

New research assignments which have materialized since the end of the war with Japan have made necessary the leasing of 1000 additional sq ft of space by Bjorksten Laboratories, Chicago, which specializes in work on plastics, rubber fillers, organic synthetic compounds for special purposes, etc. The

THERMOPLASTIC Scrap

BOUGHT — SOLD
or RECLAIMED for You!

ACTIVE IN THE PLASTIC FIELD for 22 YEARS

A complete converting service!
It will pay you to investigate our facilities for reworking your scrap.

CELLULOSE ACETATE — CELLULOSE BUTYRATE
STYRENE VINYL AND ACRYLIC RESINS

PLASTIC MATERIALS

A Dependable Source of Supply for re-worked Cellulose Acetate and Cellulose Butyrate molding powders

GERING PRODUCTS INC.

North Seventh St. & Monroe Ave., KENILWORTH, N. J. Chicago Office: 622 W. Monroe St.

The New

CELLOPHANE-LIKE PLASTIC COATING

There is only one plastic —CELLO-PLASTIC. Do not accept substitutes

Now available in many beautiful colors and for every purpose.

Cello-plastic

Brings New Colorful Beauty and Durable Protection to FLOORS ★ WOODWORK ★ WALLS ★ EXTERIORS

Plastic is now prepared in liquid paint form for use in home, office, store and factory. This has come about through the formulation of synthetic resins with specially processed oils combined with the finest paint pigments. A Cello-Plastic product is available for almost any type of finish or surface. Does not chip or crack!

BRILLIANT ★ SMOOTH ★ TOUGH ★ DURABLE

FOR FLOORS Cello-Plastic (transparent) is a *non-skid* plastic finish for all types of floors. Outwears wax 200 to 1. This amazing new treatment gives floors a "cellophane-like" Plastic finish. Eliminates pores that absorb dirt, thus making floors easy to clean. Ideal for all surfaces including wood, concrete, linoleum, asphalt, tile, rubber, composition, etc. *Eliminates waxing and polishing.* Unexcelled for marine use.

EXTERIOR This modern finish is a severely tested product that surpasses old fashioned type house paints. Pigmented with Titanium Dioxide, the whitest and best covering pigment, combined with kettle processed linseed oils and plastic resins, it makes a rich, colorful, lasting coating. Makes homes and buildings outstanding. For use on wood, stucco, brick or shingle.

INTERIOR Brings new glamour into homes—protects floors woodwork, furniture, etc., with its long-lasting, "cellophane-like" Plastic finish. Easy to apply—flows smoothly—leaves no brush marks—self leveling.

Product liability underwritten by one of America's largest insurance companies.

CELLO-PLASTIC CHEMICAL CO.

417-419 BLVD. OF ALLIES, PITTSBURGH 19, PA.

added space provides expanded facilities for complex or "long range" research work for clients.

A newly equipped and modern fabricating plant at Trenton, N. J., has been opened by the Panelyte Division of St. Regis Paper Co. Adding more than 60,000 sq ft of production space to Panelyte's facilities, the new plant, according to Roy G. Ferguson, president of the company, will utilize new machinery and machine tools in the handling of fabricating operations.

An Auxiliary Service Department has been established by Special Machine Tool Engineering Works, New York City, which specializes in close tolerance machined parts. The new department is designed to help facilitate the solution of various manufacturing and production problems in peace-time industry.

The business, good will and assets of the induction heating division of Van Norman Co., machine tool manufacturers, Springfield, Mass., have been acquired by Lepel High Frequency Laboratories, Inc., New York City, according to recent announcement.

Manufacture of all induction heating has been discontinued by the Van Norman Co., all maintenance, sales, and service of Van Norman units being henceforth to be handled by the Lepel organization.

A Canadian branch of Creative Printmakers Group has recently been opened at 2424 Yonge St., Toronto, Ont., under the general managership of Fred H. Edginton, with Eric Hardman as sales manager. Specialized work will be handled in decorating of packages and containers of plastics, glass, wood and metals, and the company advises that the same type of decorating facilities as those at the home plant, in New York City, are available at the Canadian branch.

Recently appointed sales representatives for F. J. Stokes Machine Co., Philadelphia, are Harold G. Roman, Portland, Conn., as New England representative; and Williams & Wilson, Ltd., with offices in Montreal, Toronto and Windsor, who will represent the company throughout Canada, east of Manitoba.

New York City sales offices have been established by Tennessee Eastman Corp. at 10 E. 40th St. Sales of the company's *Tenite,* and of its cellulose esters, in the New York area will be in charge of William L. Scarles; F. L. Bume will handle the recently-introduced line of Eastman acetate dyestuffs, and sales of other Tennessee Eastman chemicals in that district are also to be made from the new offices, it is announced.

A. M. Tenney Associates, Inc., located at the samc address, continue to act as sales representatives for the company's acetate rayon and staple fibre.

Additional enlargement of its recently expanded facilities at Plainfield, Conn., is being planned by Plastic Film Corp., for the production of moisture-vapor barriers for industrial and consumer goods packaging; plain and novelty cast films for wearing apparel, upholstery, draperies, and a variety of consumer goods.

With an extensive engincering background in the fields of plastics, wood, metal, and rubber, Frederick G. Schranz has announced establishment of his own offices at 90 W. Broadway, N. Y., whcre he will serve as consulting engineer and manufacturers' representativc.

A hydraulic and special machinery division has been established by Williams Sellers & Co., Philadelphia, to be under the direction of John C. Graf as sales manager and John B. Cutler in the capacity of chief engineer. The new division, it is announced, will handle a comprehensive range of hydraulic presses and special equipment for use in the fields of plastics, rubber, and ferrous and non-ferrous metals.

A change of company name and location has been announcd by Bentley-Dunham Engineering Co., Rockford, Ill., which will henceforward operate under the namc of Productioncering Associates, at 526 West State St.

PEOPLE

J. G. Short, Jr., has been appointed manager of the Atlantic District of the chemical department of General Electric Co., headquartering in Philadelphia; **N. A. Freuden** has become sales manager of molded products of the company's Plastics Divisions, and will have his headquarters in Pittsfield. Both appointments became effective January 1.

* * *

Leonard F. Smith, formerly director of advertising and sales promotion for Tubize Rayon Corp., has been appointed to a newly created position with Plastic Film Corp., where he will supervise the market development, merchandising and promotion of the company's growing line of new peace-time products.

* * *

Recent appointments on the staff of Hercules Powder Co. include those of **Robert L. Skov** to sales manager in the West Coast district; **Floyd L. Boddicker**, manager of cellulose products operations at the Hopewell, Va., plant, succeeding **Clark B. Kingery**, who has been named assistant director of personnel for the company; **Charles H. Gant**, manager of the Parlin, N. J., plant, where he succeeds **Edward G. Crum**, who has become assistant general manager of the cellulose products department in Wilmington.

C. B. Kingery

C. H. Gant

R. F. Wolf

Ralph F. Wolf has joined the staff of Standard Chemical Co., Akron, O., it was recently announced by C. J. Harwick, president of the company. Prior to this appointment, Mr. Wolf was chief chemist of Polson Rubber Co.

* * *

Dr. Earl W. Flosdorf has resigned from the post of assistant professor of bacteriology in the Medical School of the University of Pennsylvania, to become director of research and development for F. J. Stokes Machine Co., Philadelphia.

* * *

James A. Windram has been appointed manager of the St. Louis district of the industrial products division of B. F. Goodrich Co., succeeding **George Livermore**, who is retiring from the company.

* * *

S. Askin, industrial relations director of Heyden Chemical Corp., New York City, has been appointed assistant secretary of the corporation.

* * *

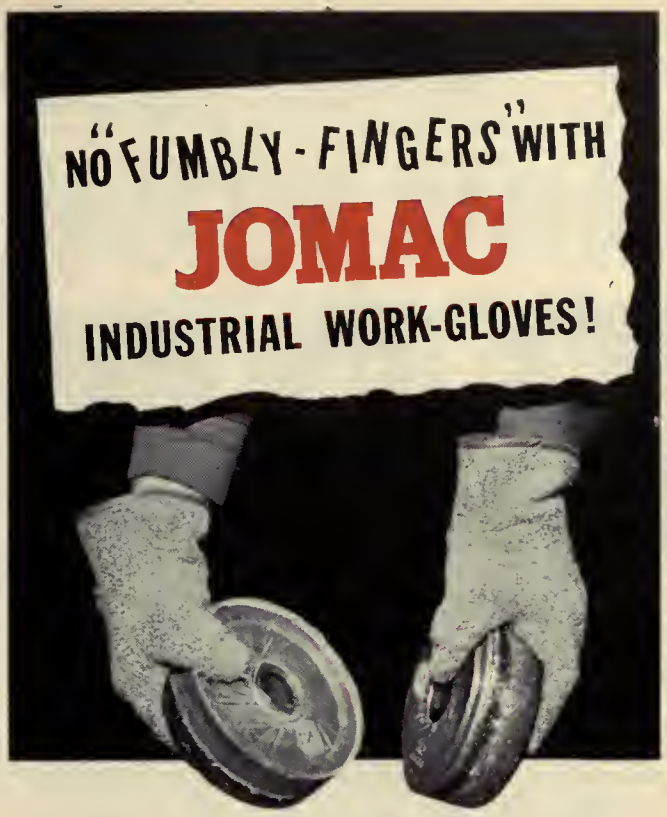
Foster W. Berry, until recently chief of the wood and plastics unit of the Inspection Div., Army Air Forces, is now a member of the staff of Engineering Associates, St. Charles, Ill., where he will work on research and industrial development on wood, pulp, and plastics.

* * *

Aircraft Screw Products, Inc., Long Island City, N.Y., has appointed **Donald McClain**, of Manchester, Conn., as its engineering representative in the New England area.

* * *

Robert L. Richards has been made manager of the nylon division of E. I. du Pont de Nemours & Co., succeeding **Charles A. Cary**, who has been appointed assistant general manager of



"Fumbly-fingers" in plastics work are worse than a bull in a china shop. You've got to have a quick, sure grip . . . and a glove that gives you unfailing protection, *plus* money-saving, longer life! Impossible? No . . . not with JOMAC Industrial Work-Gloves. The triple features of this superb industrial work-glove . . . flexibility, safety, and long-life . . . make it a friend of the plastics industry . . . from top-executives to worker!

There's no guesswork in JOMAC . . . there *is* a scientific reason for its superiority. Its extraordinary fabric is "loop-finished," with hundreds of "air-cell" cushions *lock-stitched* into place. JOMAC Industrial Work-Gloves are *made* for *longer* wear ...they give up to 7 *times* the wear of ordinary work-gloves. Washable, they can be laundered repeatedly . . . help to curb skin-infections. Address inquiries to C. Walker Jones Co., 6135 N. Lambert Street, Philadelphia 38, Penna.

"SHAKE HANDS WITH SAFETY"

JOMAC

INDUSTRIAL WORK-GLOVES

Try JOMAC'S "Pencil-Pick-up Test"! You'll see the difference!

the company's rayon department. **Arlington Kunsman,** who has been director of production of the rayon division, succeeds Mr. Richards as assistant manager of the cellophane division.

John A. Burckel, special assistant to the general manager of the plastics department, retired from the company November 1.

* * *

George W. Flanagan, who has been in charge of *Geon* latex development, has been made manager of the B.F. Goodrich Chemical Co. development laboratory, Cleveland, where he will direct the activities of a technical staff engaged in materials and process development work on the company's resins, plastics and chemicals.

G. W. Flanagan

W. Brinkerhoff

R. P. Kenney

Robert P. Kenney, formerly manager of international service for the company, has been made manager of international sales. Before joining the organization, he was chief of the vinyl resins unit of WPB.

* * *

The newly-created Engineering Division of The Davison Chemical Corp., Baltimore, will be headed by **E. B. Dunkak,** as manager, with **J. C. Albright** head of the consulting engineering section; **R. S. Van Note,** head of the equipment section; and **Kenneth H. Van Valkenburg,** head of the process engineering section.

* * *

Election of **George H. French** as a director of The Davison Chemical Corp., Baltimore, for a term of 4 yrs, has been announced by the company.

* * *

Harry W. Gleichert has been promoted from assistant director to director of sales for the Columbia Chemical Division of Pittsburgh Plate Glass Co., and will have his headquarters in Pittsburgh.

* * *

John C. Leppart has been named assistant to the operating vice-president of Southern Alkali Corp., Corpus Christi, Tex., which company is owned jointly by Pittsburgh Plate Glass and American Cyanamid & Chemical Corp.

* * *

Albert J. Capalbo has joined the staff of Plasticote Co., Paterson, N.J., in the capacity of chief chemist in charge of production, where he will work on further development of the company's recently-announced line of synthetic resin finishes, and the engineering and construction of additional coating equipment especially designed for their application to fabrics.

* * *

Following his resignation from the presidency of Setter Bros., Inc., and from the office of chief of the plywood and veneer branch of WPB, **Clifford P. Setter** was recently named vice-president and chief administrative officer of United States Plywood Corp.

Also announced by the company is the appointment of **James Callanan** as director of purchases.

* * *

V. A. Dockendorff, industrial designer, Chicago, has announced that he is now affiliated with Belmont Radio Corp. in the capacity of cabinet and appearance designer, having previously been associated with the Galvin Mfg. Co.

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ENGINEERING — News Letter —

By LEWIS WINNER
Market Research Engineer

Cactus Provides Plastics

When rubber became scarce and we learned that normal supplies would not be available for several years, the problem appeared quite complex to many, but not to the chemical and plastics engineers. They indicated that they knew of effective substitutes, and they did, as the records now reveal . . . with plastics again a major contributor. Two types of approach were used in development; one involved the use of new natural resources to provide substitutes, and the other employed combinations of reclaimed rubbers with plastics.

In the new-resources category appeared an intriguing process utilizing the cactus plant. Discovered by P. B. Roberts of Tyler, Tex., the method provided a cohesive resilient solid extracted from the viscous liquid of the cactus plant. The juice from the plant was named *xerotex* while the resultant solid was identified as *xeroplastic.*

The cactus plant solid has many interesting properties. It is spongy, elastic and tenacious, and, in addition, it can be vulcanized. That is, it may be partially vulcanized by first melting and then allowing to cool. By the addition of suitable vulcanizing agents it can be further vulcanized. The solid is also non-inflammable and fire-resistant. It is not soluble in petroleum ether or carbon tetrachloride, nor in any of the usual

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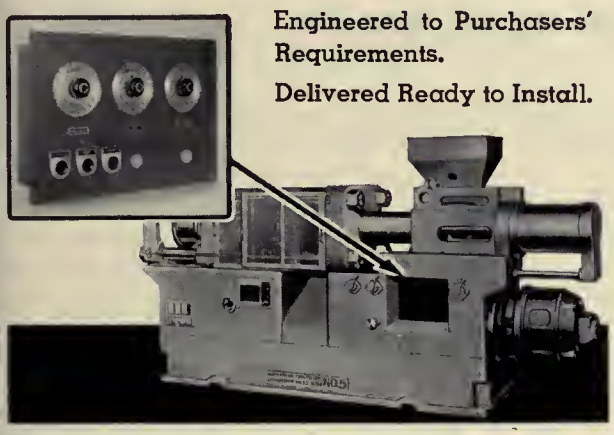

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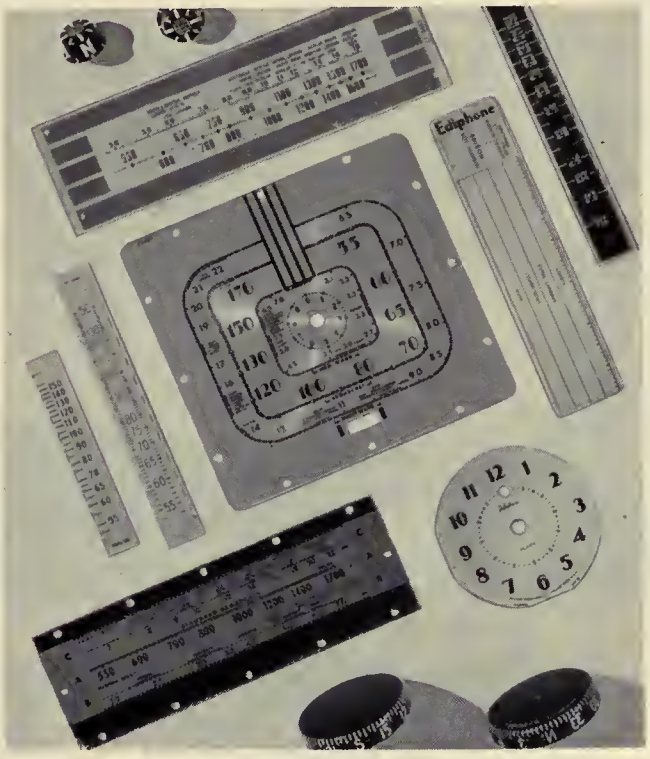

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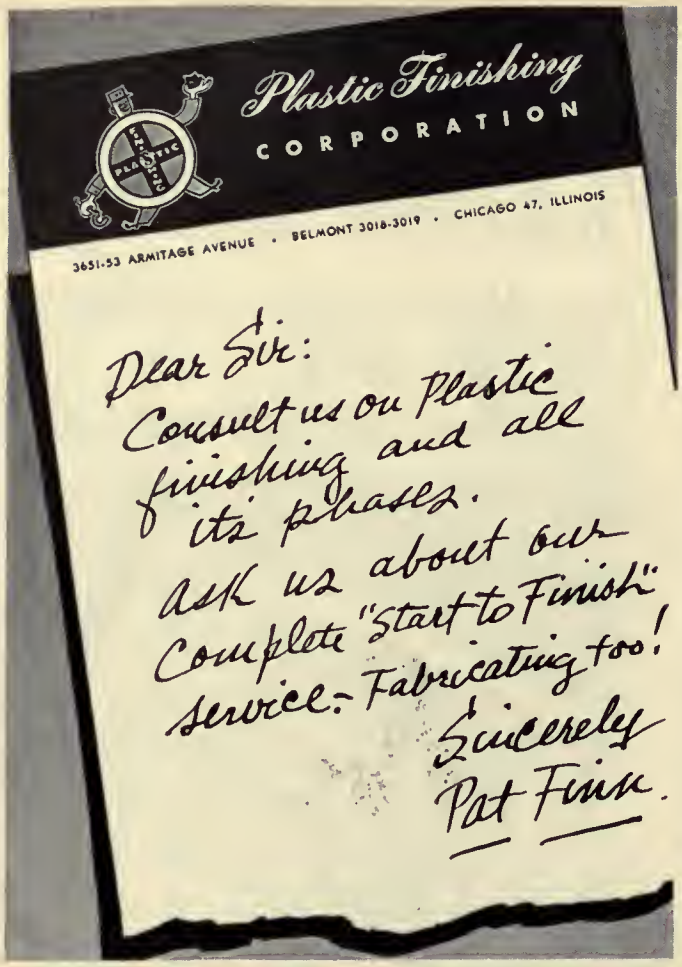
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hydrocarbon solvents which are employed to dissolve latex recovered from the rubber tree. In view of the tenacity of the material, it is possible to apply it to fabrics, metals, and to other plastics.

The solid can be readily formed, or poured into molds. This operation does not impair its rubber-like qualities. Molding can be performed by pressure and other methods.

In extracting the juice, the leaves, branches and roots of the plant are fed through closely aligned rollers or grinders. Greater recovery is possible if the leaves and the body of the plant are mangled and crushed, and the resultant mass, including the fibers and liquid, placed into a vat to which water has been added. Separation is possible by pressing the mass over a fine sieve.

Dry Glue as Coagulant

After the liquid has been cleaned and recovered, it can be coagulated into a jelly-like mass. Casein, fish and vegetable glues are good coagulants. Several other interesting materials have also been used as coagulants; brown sugar, molasses, and even dried blood.

Usually about 3% to 75% of a glue in dry form has been used as the coagulant. After the plant juice and the coagulant have been mixed, the resultant mass is allowed to set for several hours at temperatures preferably above freezing. A solid will result. As stated previously, this solid can be heated for application.

The unusual molecular structure of the cactus plant juice provides the resilient and elastic properties. It seems as if in the molecular character of the juice there are lubricated molecules, one molecule apparently sliding over another.

Any of the cactus plants may be used, although tests indicated that there were four particular types which offered best results. They are: Opuntia, Echinocactus, Cereus and Echinocereus.

Sulfophosphine Halide Treatment

In a reclaimed rubber method use to provide a flexible thermoplastic, an organic sulfophosphine halide has been used to treat the rubber. Developed by Thomas W. Bartram of Nitro, West Va., the process provided a vulcanizable plastics material with high resiliency. Not only can crude India rubber or ground scrap rubber be used, but the chlor butadiene polymers (*Neoprene*), styrene, and polymerized cashew nut oil can also be employed.

Reaction with Sulfur

The sulfophosphine halides can be prepared by reacting the organic phosphine halide with sulfur.

In preparing one mass of this new rubbery thermoplastics about 100 parts of ground truck peels were heated with dry toluene to swell and soften the rubber. Then about 50 parts of crude tolyl sulfodichlor phosphine were dissolved in toluene and added to the previous mixture and stirred. This stirring was maintained for 20 hours at a temperature of 55° to 60° C. The toluene was then removed by distillation, and a thorough steaming, with live steam, was used to clean the mass. This step was followed by a washing with water, and the washed product was dried to a constant weight in an oven under vacuum. This process provided about 116 parts by weight of a hard resin.

Improved Safety Glass

Complete control and the resultant elimination of "blow-ins" in laminated safety glass has been the object of many experiments and developments. A recent method devised by Joseph D. Ryan of Toledo, O., appears to have solved the problem by an effective sealing of laminated sheets, providing a substantial unitary structure. These blow-ins, which contain trapped air, have often voided the general utility of safety glass.

Heretofore, when using cellulose acetate for the plastics layer, or polyvinyl acetal resins, the blow-in problem has been serious. With cellulose acetate, it has been customary to seal the edges of the laminated sheets by forming a channel around the edges of the sheet and then filling this channel with a sealing compound. While the problem is not too grave here, because of the flexibility of the sealing process, it is nevertheless an annoying procedure. The synthetic resin plastics problem is more complex. Here no edge seal is used and thus even rela-

tively minute blow-ins on the exposed edges of the laminated sheets cause rejects. Grinding has been used to eliminate the blow-ins where they are very close to the edge, but this has been a costly procedure.

These problems have been overcome by coating the edges of the sandwich plates, either partially or in their entirety after prepressing, with an improved type of sealing material that consists of a lacquer, which forms a relatively thin coating upon the edge of the glass sheets. The sealing material can be washed away after the sheet has been removed from the autoclave. Where the autoclave fluid hardens the sealing material, a scraping tool can be used to remove the seal.

One sealing lacquer developed utilized cellulose acetate butyrate, acetone, cellosolve acetate, dibutyl phthalate and ethyl acetate. (Cellosolve is the monoacetic acid ester of monoethyl ether of ethylene glycol.)

According to Mr. Ryan, there are many causes of blow-ins. They may arise due to poor gage of the plastics; they may result when the glass itself shows a rapid change in thickness from one closely adjacent point to another on the edges. Internal strains in the plastics, which tend to right themselves at high temperatures, used in the final compositing operation, are another cause of blow-ins. The strains prompt plastics shrinkage. The resilient character of the plastics is another cause of blow-ins.

The sealing material developed by Mr. Ryan does not interfere with the final overall structure of the lamination. The process is being used by the Libby-Owens-Ford Glass Co.

Peace-Time Uses of Plastics

While we have heard of the unusual developments that our postwar products will include, specific engineering data have not been too plentiful. These restrictions, we have been told, have been prompted by the usual trade secrecy problems. With actual production now under way, however, analyses of many of these projects will be possible. One such postwar development that can now be discussed involves a plastics ice tray grid. This grid, using vinyl plastics, permits the automatic release of ice cubes by employing the principle of heat conduction control.

In this method, conceived by Theodore W. Rundell of Abington, Penna., the ice tray itself is composed of a metal having a relatively high-heat conductive capacity. The plastics grid which fits into this ice tray has a lower heat-conductive capacity. Thus in the freezing process the water freezes first along the walls of the metal tray and continues to freeze in a direction away from these walls, because of the relative difference in heat conduction of the metal tray and the plastics grid. The expansion forces arising from the freezing water are directed toward the plastics grid, resulting in displacement. This displacement breaks the bond between the ice cubes and the tray. It is thus possible to lift the ice cubes from the tray very easily.

Philco has received the rights to this development and will probably feature it in some of the company's refrigerator models.

Tests for Plastics Shoe Materials

In recent testing of plastics materials for shoe soles, the Bureau of Standards studied thickness, density, tensile strength, elongation at break, stitch tear, change and thickness on immersion in water, loss in weight on heating, flex fatigue life at 32° F, and abrasion resistance. It was found that the more satisfactory grades of vinyl plastics shoe material met the requirements of: Tensile strength (min) 1500 lb/in²; stitch-tear strength dry and wet (min) 30 lb irrespective of thickness of material; flex-fatigue life at 32° F (min) 1,000,000 cycles; bend test at 0° F, aged and unaged (min) 10 bends over a ½ in-diam mandrel; abrasion resistance, leather machine (min) 6000 revolutions per millimeter; abrasion resistance, Taber machine (max) 75 mg per 1000 revolutions. None of the material which met the above requirements contained fibrous fillers. END

Cumberland Plastics Granulating Machines

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Four Cumberland machines, built specifically for plastics, give a wide range of capacities. The #0 model is frequently used one per injection molding machine, so that the molding operator disposes of the sprues and runners as made. The #½ machine, illustrated here, has capacity for granulating the scrap from two or three molding machines. Larger sizes are the #1½ and the 18", which afford more capacity and grind material of large cross section.

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plastics overseas

Britain's Chemical Industries

Far-sighted British scientists and business men, planning the large-scale long-term replenishment of this country's depleted cupboards, shelves and money chests, are moving with speed and decision the pivot of Britain's economic structure from the heavy iron, steel and coal industries to the light inorganic and organic chemical industries.

These moves are designed to rebuild Britain on a permanent prosperity footing and swell the volume of her trade with many millions worth of hitherto untapped business from abroad through the exploitation of test-tube discoveries made in wartime British chemical laboratories.

Especially in the plastics field of applied chemistry (now rapidly becoming one of Britain's most valuable capital assets) this imaginative approach to the industrial problems of the modern age is providing a tremendous fillip to the British plastics industry's output of goods for home consumption and overseas trade, multiplying its productive capacity to such an extent that it already now constitutes perhaps the largest single plastics fabricating unit in the whole of the eastern hemisphere.

Looking Ahead

Taking shape in practical form is a scheme, initiated by the British Plastics Federation, aimed at coordinating the merchandising of plastics commodities at home and overseas.

This scheme calls for the setting up of a Plastics Trade Center in London, comprising an exhibition hall housing a permanent, side-by-side display of old and new plastics materials, machinery and finished products, and including information, promotion, inspection and other offices, staffed by teams of experts, for collecting, collating and disseminating vital information and data, stimulating worth-while business lines in foreign markets and maintaining contacts with prospective buyers abroad, safeguarding quality standards, streamlining sales and publicity, etc.

Attached to the Plastics Center also will be a special research organization for investigating, among other things, the practicability of placing the almost exclusively coal-based British plastics industry (at present handicapped by the exorbitance of current coal prices over here) on an alternative basis to raise its competitiveness in world markets.

New Plastics Products

The crop of new plastics products now trickling into Britain's civilian market evidences the forcsight as much as the ingenuity with which the British plastics industry is now endeavoring to find new outlets for its expanded manufacturing potential.

Among these new products are two types of weatherproof plastics aerial masts for use with vehicular radio-electronic equipment.

The first type, intended for application in mobile communication units and aircraft, is a portable telescopic mast consisting of four tubular lengths of laminated phenolformaldehyde fabric base extending to a total length of 27' 6", which it is possible to erect by the use of boom and tackle in a few minutes in an emergency; the second type is 50' long, and specially built for radio position checking.

Marketed by the British Micanite & Insulators Co., of London, the two radio masts combine lightness with structural strength and, it is claimed, neither shake nor whip in storms, hurricanes or blizzards.

Another product throwing an interesting sidelight on the many unusual applications of plastics in Britain at present is a

plastics bee-feeder molded from urea formaldehyde powders.

Manufactured by the Universal Plastics Co., a London company, this all-plastics device consists of a circular basin with detachable lid, containing at the center a molded funnel with 3/16" cutaway steps to facilitate bee-feeding.

Simple in design and construction, and weather-resistant, the plastics bee-feeder is produceable in large quantities economically and admirably suited to replace existing equivalents made of wood or metal.

Railway Equipment

Long-distance train passengers in England were recently asked by leading British railway companies to help in designing the 25,000 new railway cars which will have to be built in the near future to cover current rolling stock depreciations and shortages.

From answers, given to circularized questionnaires enumerating desirable innovations for inclusion in new passenger coaches, emerged the information that 78% of the traveling public favor compartments having plastics panelled walls, ceilings and doors; 62% desire plastics-upholstered arm-chairs, and 57%, detachable tables with plastics-covered tops.

The British National Physical Laboratory Ship Division Research Center is investigating the possibility of constructing coasters, colliers, tugs and similar small craft by the surface welding of sectionalized plastics prefabricates.

These investigations were started at the request of Clyde, Tyne and Mersey shipbuilders, working to full capacity on the replacement of the 6000 merchant ships lost by Britain during the war, unable to execute mounting contracts for specialized vessels of small tonnage.

Improved Products

According to British Nylon Spinners Ltd., a company recently formed jointly by British Courtaulds and Imperial Chemical Industries, British women will shortly be able to buy virtually indestructible, run-proof, shrink-proof and wrinkle-proof

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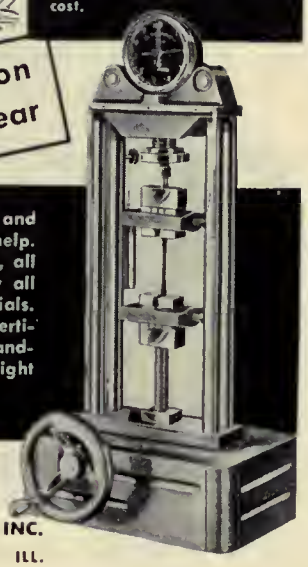

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hosiery woven from a strengthened type of nylon thread evolved by British plastics chemists during the war.

At the same time, a Leicester (England) leather-ware firm announces the development of a new vinyl plastics material, suitable for making shoes, gloves, handbags, belts, etc. The material, it is said, neither cracks nor flakes, and is practically indistinguishable from ordinary leather, but will last much longer.

Fashion-Design Applications

British fashion designers, faced with material rationing and textile shortages of all sorts, are increasingly resorting to the use of plastics for making women's apparel and accessories.

In fact, in some of London's more exclusive shops there are now appearing smart-looking gowns made from plasticized, resin-coated yarns, combining individuality and eye appeal with wearability and utility. And Arthur Banks, one of Britain's leading dress designers, recently introduced a number of models in which hemless, differently-colored plastics frills attached to dark or black bands of plastics-dipped textile fabrics add a gay touch to otherwise sedate textile dresses.

Millinery designer Hugh Beresford is currently establishing over here a new fashion in women's headgear, with uncrushable and rainproof plastics hats of the pom-pom pillbox and buttoned-cuff type.

These commodities are in great vogue among British women on account of their gay novelty, attractive design variations and infinite color patterns.

Plastics Air Strip

A floating airdrome, on which heavily laden passenger-cargo planes will be able to land, refuel and take off again in mid-ocean, has been devised by British marine and aviation engineers.

Built from wood, steel and canvas topped by closely jointed hexagonal plastics strips covered with a special bitumen compound, this floating airfield gives indication of the pattern of tomorrow's oceanic air services. END

A Consumer Speaks Up!

(*Continued from page* 90)

dene chloride are rechristened, the sooner it will be possible to teach the public the characteristics of each.

To many of the women "plastics" have been an unwelcome war-time substitute for familiar metals. The over-all scarcity of consumer goods has allowed unscrupulous manufacturers to make, from plastics scrap, merchandise which has failed to give even the minimum service expected of "ersatz" goods. Every plastics failure has built ill-will for the whole industry. When a product made from any of the older materials—wood, leather, glass or steel—fails in use, only the manufacturer is blamed, but when a urea tumbler shatters or a paper-thin cellulose nitrate soap container warps out of shape, the customer is likely to conclude that "plastics are just no good."

On the other hand, even the women who put their faith in plastics as ideal in every way have sometimes been sadly disillusioned. Spectacle frames, for example, bought with great care to complement the color of eyes or skin, faded soon to nondescript tints. None of the women, however, knew the composition of the frames, or how to select a more satisfactory product in the future.

Experience Varies Opinions

The vote on some plastics items divided strictly according to the personal experience of the wearer. Plastics soles, for example, were condemned as hot, clattering and with bad wearing qualities, and were praised as lighter, longer-wearing, and waterproof. None of the wearers had any idea of the brand or type of plastics used in the shoes, nor how to find or avoid the same material in the future.

Do you remember back to the days after the first World War when the new "artificial silk" fabric was struggling for

acceptance under a myriad of names? The American shopper saw it only as a cheap and unsatisfactory substitute for a luxury material. When, in 1924, the industry drew itself together and coined the name "rayon" for its product, the new material established itself in its own right as a comparatively inexpensive fabric with many fine qualities of its own.

The plastics industry is now in the same state of anonymity, as far as the public is concerned, as the rayon industry was 25 years ago. A few brand names are familiar to us through national advertising. But not every one of the hundreds of different brands on the market can hope to become widely known solely by its trade name.

Imagine the situation if no such names as "peaches" and "pears" existed. Then Del Monte could label their canned peaches Dela and their canned pears Delo; another canner might use the names Kerite and Kerola; and another Beran and Belon. How often would the housewife come home from the store with the kind of fruit she wanted?

Until simple generic names are adopted for each family of plastics, and used by every manufacturer in combination with his own brand name, the public will remain as completely confused as though every canner coined his own descriptive name for the fruit he canned.

The one plastics which stands apart from this confusion is nylon, which, although it was coined as a trade name, has been given to the plastics industry by du Pont. Nylon is the only plastics that the average woman knows familiarly by name. How much of its popularity is due to its simple, distinctive name? How many women would have kept alive their enthusiasm for pre-war nylon hose if they had been compelled to remember and ask for "hose made from polyhexamethylene adipamide?"

Importance of Generic Terms, Labelling

Coining and using satisfactory generic names and teaching them to the public is the first half of the battle. The second, and equally important part, is adequate labelling. It seems strange, at this point in American industrial history, that it is necessary to emphasize the power of advertising. Surely every manufacturer knows that women have learned to place a certain amount of faith in any nationally advertised product. They prefer to buy an item bearing a familiar trademark. When I have to select between two similar brushes, one labelled "made from du Pont nylon" and the other unlabelled, can there be any doubt as to my choice?

Yet for some reason these brand names are seldom found on the merchandise when it reaches the stores. Apparently the manufacturer mistakenly believes that the customer is not interested in the material which has been used in his article. One of the women who were being questioned about plastics gave a specific instance of such lack of labelling.

"When I shopped for a coat recently, I bought one bearing some such label as "Made from Forstmann woolen. Lined with Celanese taffeta." I knew that such a coat will be satisfactory in every way, for the brands are old friends. Then I turned to raincoats and found myself confronted with racks full of unlabelled 'plastics' garments. Some were coated fabric, some were transparent film, but all of unknown wearing quality. My old raincoat had gone out of style, but it had given me several years of excellent service. It was soft and pliable, summer and winter, and it remained waterproof, odorless, and unstained. In contrast, my sister's raincoat, bought at the same time, had stiffened and cracked within a single year. I hoped to get another coat like my old one, and avoid the kind my sister bought, but all I knew was that both were 'plastics'—variety and brand unknown. The sales clerk could not help me. From the collection of raincoats offered, I finally selected one by guesswork, hoping that I had made a lucky choice."

Another woman spoke almost with affection for her old

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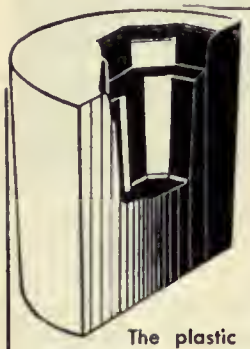

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shower curtain. "I've had it five years and I've never once had to take it down to wash it or have it cleaned. But—" the same comment occurs again and again—"I don't know what kind of plastics it is." The best this highly observant woman could say was, "It's a thick, rubbery soft material, not quite transparent. I don't think it will ever wear out, but if it does I want to get another just like it, if I can find one." Five years of enthusiasm for this product have been lost because the original curtain was unbranded! How many other women would have bought, or tried to buy, the same thing, if the owner had known its name?

The American home-maker is wise. She has been well educated in her profession. Advertising, women's magazines, newspapers, the radio programs, have taught her to shop carefully, to know the qualities desired in a certain article, and to insist on getting them. The manufacturer who assumes otherwise underestimates her intelligence. She knows that no material is perfect, that each has its limitations as well as its virtues, and she takes both into account in her selection. She knows that rayon loses its strength when wet and must be washed carefully and ironed with a warm iron. She knows that wool shrinks, that linen creases, and that cotton fades. Knowing the weakest qualities of each, she knows how to select the best for her purpose and how to treat it in order to obtain the best service from it.

Good Publicity Educates

The elaborate publicity campaign which preceded the introduction of nylon hose not only built up a tremendous demand but subtly warned the public about one of its characteristics. Most women had been buying an approximate size of hose, knowing that the silk would accommodate itself to the actual shape of the foot and leg. Nylon hose, being preformed to fit, must be selected in exactly the right size for satisfactory wear. Thanks to adequate advertising and labelling, most women knew this and were guided accordingly in their purchases.

Perhaps the plastics manufacturers assume that if they ignore the drawbacks of a material the public will never know of it. Do they realize that many older women, brought up in the days when cellulose nitrate was the only familiar plastics, assume that all plastics are highly inflammable? One woman in the group questioned condemned all plastics as dangerous for this reason, "I had a friend who was badly burned when her comb caught fire. I've never wanted any plastics around since." A quick demonstration in an ashtray, using a comb from my purse, convinced her that it was made of a different, far less flammable plastics. But how many other women cling to the same belief?

As a shopper starved for consumer goods, I have a long list of wants, and not too much sales resistance. In the field of plastics, as in every other field, I want to buy sensibly. That means I will choose, if possible, a familiar brand. I want to know the kind of material I am getting, its characteristics, and, more especially, its weakest points. Will it fade? Will it chip? Will it crack in the cold or soften in the sun? Must I protect it from heat or perspiration or alcoholic liquors? Can I wash it safely in hot water with soap? Unless I know the answer to such questions I am buying in the dark—if I buy at all!

We consumers need the cooperation of manufacturers and retailers in three ways: in simplified terminology, so we may recognize and remember the various kinds of plastics; in educational advertising and publicity, so we may learn the characteristics of each kind; and in accurate and complete labelling, so we may buy wisely and care for our purchases intelligently. END

EDITOR'S NOTE: The Informative Labelling Guide recently issued by the Society of the Plastics Industry for use by manufacturers of consumer goods made entirely or substantially of plastics is an important step toward supplying some of the deficiencies in plastics education pointed out in this article.

Breathe Easier

(*Continued from page 32*)

An oblong hole for insertion of the air hose is cut in the chest plate by a router. This form of aperture matches an eccentric connection, which, upon being turned, exercises pressure on a sponge rubber gasket at the end of the hose.

In the remote instance of an untrue press job, the thermoplastic sheet may be reheated and reshaped. Obviously if the sheet is to be pressed a second time, the imperfection must be noted before the selvage is trimmed.

Thus, through use of phenolic molds, which were fabricated by the Rezolin Co., Beverly Hills, the operation became a simple punch and die job.

Fabrication of plaster patterns for the phenolic dies was expedited by using, as basic structures, the aluminum jackets previously manufactured for the waist-length breathing chamber. Mock-ups for the patterns became necessary, for the product was redesigned in several points to afford increased comfort for the wearers. Alterations included lowering the neck, raising the shoulder, and providing greater breathing space within the *Plexiglas* jacket. These changes were effected in the mock-ups by pressing plaster upon the aluminum surfaces where greater space was required, and in cutting away portions of the aluminum.

Tolerances for the 3/16" *Plexiglas* sheet were achieved by pressing and shaping wax sheets upon patterns for the phenolic dies.

Aside from shop advantages rendered by phenolic dies, the speed and economy with which they were produced stood as factors, which influenced their being chosen. Production of patterns and phenolic molds for the small, medium, and large acrylic jackets, as reported by the Rezolin

The time is coming when you may require *specialized* experience on vinyl resin, pyroxylin or other plastic coatings.

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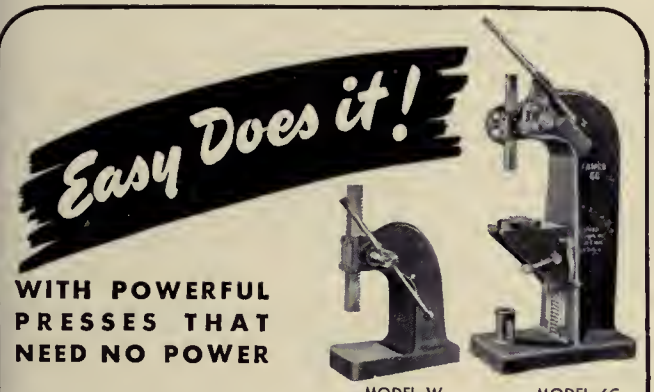

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Co., respectively was accomplished in 45, 50 and 60 hr, a total of 155.

The same company estimated that patterns and production of metal press dies would entail expenditures of $700, $800 and $1000, respectively, in all $2500. The economy inherent in phenolic molds is represented by the actual production costs, which respectively were $300, $375, and $475, a total of $1150, which meant saving $1350 or 55%.

Fabrication of the respirator in methyl methacrylate establishes a still further economy, as shown in the comparison of costs between "iron" and "plastics lungs." While the metallic creation involves a full length respiratory chamber and the acrylic jackets are but waist length, it should be borne in mind that three encasements are provided with the plastics therapeutic device as against one in metal.

As yet, less than 100 "plastics lungs" have been fabricated, but a sales program for 1500 complete units, of which one-third will be for export, is planned for the ensuing year. Of the 100 completed units, many have been dedicated to research and experimentation in studies of their application to various pathologies.

While the aluminum device has been applied only in such emergencies as drownings, asphyxiations, and other accidents, research with the plastics unit is proceeding in such fields as cardiac edema, gangrene in extremities, cynosis, lung congestion with tracheotomy, combat shock, various fatigues, paralysis, coronary thrombosis, diabetes, anemia, Buerger's and Parkinson's diseases, neuritis, alcoholic coma, asthma, pneumonia, poliomyelitis, tuberculosis, and many other ailments of mankind.

Practice, however, is said to show that the therapeutic device maintains body temperature in bedfast cases, hastens post-operative recovery by eliminating the exertion of drawing and expelling the breath, and serves in those emergencies to which its aluminum prototype has been applied.

Upon being placed in the respirator, patients are reported to express relief as the mechanized ebb and flow of room temperature air banishes the sense of breathing effort. Strain upon the heart is eased, with complete body rest ensuing. As the machinery performs its work, the patient may be respirated at a normal, slow, or rapid rate of speed, but always without personal exertion.

Naturally, the arterial supply and venous return is facilitated by the action of the effortlessly moving human chest. High aeration of the blood stream therefore is achieved, and mechanical aid is rendered to break up circulatory stasis.

Instructions for cleaning and disinfecting the methyl methacrylate jackets after they have gone into service stress the need of maintaining visibility. As a means of avoiding surface scratches, nurses are advised to use sponges when applying detergents. The fabricator points out that heats approaching 200° F may be employed before danger of warping may be anticipated.

Plastics has played an important part in production of syringes, catheters, instrument handles, X-ray apparatus, laboratory paraphernalia, and other surgical equipment. Acrylic has demonstrated its ability to transmit light around curves in making medical examinations. The performance of methyl methacrylate as the material for a respiratory chamber seems destined to inaugurate a still greater trend for plastics in therapeutic devices, particularly where transparency is an important requirement.

Chronic patients, who for years have been confined in metal breathing appliances without normal use of arms or legs and who have been deprived of standing erectly or sitting up in bed, may be expected to welcome the innovation of the "plastics lung." For one such invalid, whose nine-year incarceration in metal has developed a physical abnormality, an individually designed neck opening, involving special tooling, is being prepared. END

More Materials in 1946

(*Continued from page 96*)

with substantial increases in availability of plastics materials effective late in the year. Major consuming industries of the former volume plastics materials, such as the cellulosics, acrylics, phenolics, ureas, and the vinyl resins can anticipate increased supplies as indicated above. A much greater percentage increase and a substantial tonnage increase in polyethylene, polystyrene, the new cellulosics, nylon, and certain other new plastics now make it possible to include these in future engineering plans.

Industries such as automotive, radio, aircraft, transportation, housing, mining, farming, motion pictures, and consumers goods—including washing machines, electric irons, vacuum cleaners, oil burners, refrigerators, etc.—have depended upon plastics. Material manufacturers are confident that the expansions now under way are adequate to take care of them. Therefore, they can continue to plan on materials being available and to design and plan future production to use plastics. END

Producing Better Printing Inks

(*Continued from page 38*)

fancy. Many ink makers continue to use linseed and other natural drying oils. Though this method will continue indefinitely in some fields of printing, the superior qualities of the new inks are bound to assert themselves more and more as time goes by and competition places a premium on finer properties and production speed. This is especially true where new requirements arise in the development of new materials and products. An apt example is the packaging industry. When cellophane began to replace paper for wrapping, new inks had to be formulated that could meet a new set of requirements, like resistance to immersion in melted wax and to the alkalinity of soaps, as well as to rubbing and scratching. Inks for food and cigarette packages have to be odorless and non-toxic. These conditions could be met in many cases only by the use of new formulations which included synthetic resins.

As to the future of printing ink, the words of Dr. Albert E. Gessler, director of research for Interchemical Corp., are as valid today as when he wrote them in 1939: "It is difficult to tell what the future will bring. However, a number of developments seem to be so close at hand that research men believe that the next 20 years will bring still more remarkable inks." END

Photographs through courtesy of International Printing Ink, Dow Chemical Co., Anigraphic Process Co.

Feeding ink to machine used to print labels on bottles

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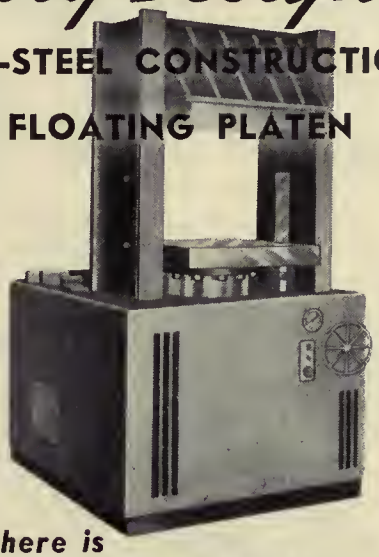

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A. BAMBERGER plastic materials

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And Now It's Luggage

(*Continued from page* 40)

market showed that at —60° F no cracking, crazing, or brittleness occurred and that the material withstood a temperature of 260° F without softening. U. S. Testing Laboratories found that it possessed excellent resistance to abrasion. Tests to determine the effects of vermin, acid, and grease proved the vinyl sheeting resistant to these common causes of failure.

Less scientific, but also interesting, was the experience of a pilot of a world airline who, in the course of 15 months of global flights, exposed the Boylastic luggage to many types of climatic conditions, and found that it stood up very well. In other tests, men's and women's bags were shipped 15,000 miles by express. When the surface dirt and grease had been removed by simply rubbing with a damp cloth, the bags showed no signs of peeling, chipping, cracking, mildewing, or tackiness.

Staple Colors for Mass Production

When it came to choosing a color, a committee of luggage buyers chose two neutral brown shades of chestnut and oak from a wide selection, since these are the staple colors. Red, blue, and green were not chosen, because Boyle wished to concentrate on a two-color line, which could be mass produced at low cost, rather than on a line which, while offering a variety of colors and styles, would be expensive.

Boyle buys a light muslin or cheesecloth for the backing in widths ranging from 38 to 54". The plastics material, according to the luggage company, possesses all the necessary bag requirements in itself, but the cloth backing facilitates cementing the plastics sheeting to the frame of the bag. The fabric-backed Boylastic costs less than leather because of economies effected in production, as well as because the basic plastics material is less expensive than the quality of leather which would be needed for luggage of the same style.

Calendering the backing to the plastics sheeting is carried out at 350° F with no pressure needed other than that of the calender. When ready for cutting, the fabric-backed sheeting is piled up in stacks of 50 to 100 layers on long tables. (The vinyl material used will not stick to itself, so no interlayer of cellophane or any other sheeting is used.) Then several thousand pieces are cut at one time. Following cutting, the fabric-backed plastics is glued to the frames with special resin-based adhesives.

Advantages in Plastics Manufacture

Boyle uses two types of frames: duraluminum for the soft-sided bags, laminated wood veneers for the other types, each requiring special adhesives. After the fabric-backed plastics has been glued to the frame, the next steps, involving stitching, turning, and additional cementing, are essentially the same as in conventional bag making. But the advantages in manufacture which the plastics makes possible are: (1) the width of the roll is optional, since it can be made as wide as needed, provided the machinery is available, cutting losses thus being eliminated; and (2) uniformity in thickness and in color reduces wastage of the material.

Boyle's leather models in styles exactly similar to the plastics models afford a convenient basis for price comparisons. A smooth cowhide leather bag, for example, costing $31.50 retails at $55.50. Its plastics counterpart costs $13.50 and retails for $24.50.

Some interesting styles in the plastics line are the 10½" by 15½" "Sleeper Plane Bag," for light travel, which is

sold for $20.70, including tax; the zippered soft-sided "Country Club Bag," which retails at $28.25; a generously proportioned man's weekend bag case (26" by 18" by 9") which retails at $35.50; and the large pieces, such as a woman's 29" all-purpose wardrobe case, the 26" man's tray wardrobe case, and the 29" three-suiter.

The Boylastic bags are scheduled for national advertising and, in addition, will appear in full color in the editorial pages of *Esquire, Mademoiselle,* and *Bride's Magazine.* Dealers and retail executives are informed now about promotion plans through the medium of Boyle's "Bulletin for Buyers." Show cards and spot-sale displays are "Introducing Boylastic" now, and interesting window displays are in preparation for a large number of the stores who are featuring this line.

Plastics Luggage Sells Well

Owing to difficulty in procuring plastics materials, the company has, up to this writing, shipped only 2500 bags. These have been distributed to leading stores, whose buyers report, along with re-orders, that the bags have sold out completely.

Plastics luggage appears, then, to be commercially practical. It does not, of course, hope or intend, for the present, at least, to compete with expensive leather insofar as variety of color, texture, and grain are concerned. The trend seems, rather, to be toward extremely sturdy luggage of pleasing design in the medium price group.

Other luggage manufacturers are giving thought to the use of plastics, if not actively engaged in development work. Wheary, Inc., for example, reports experimentation with plastics and plans for putting new plastics luggage on the market at the completion of its reconversion to peace-time production.

END

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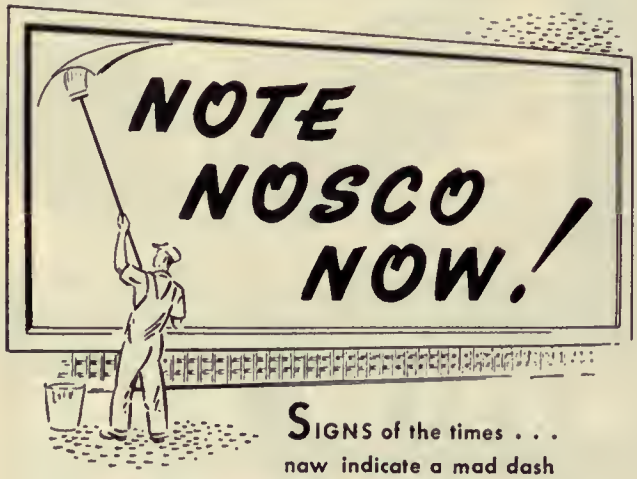

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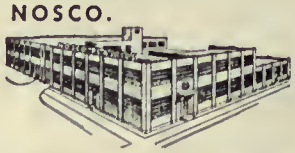

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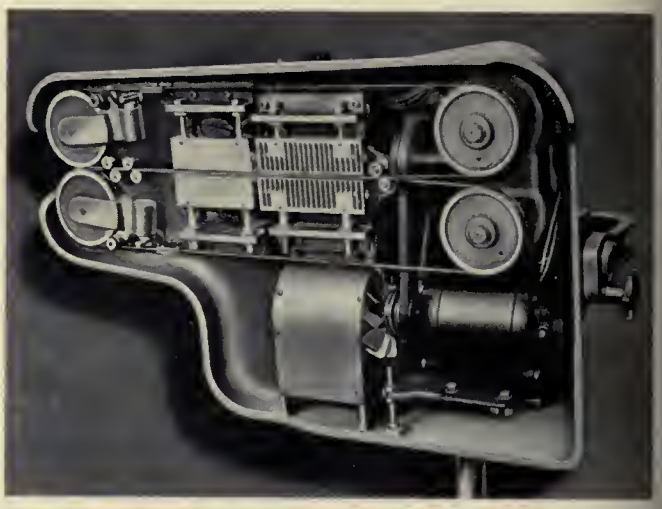

New "Sara Sealer" is miniature production line in itself

ALTHOUGH immediate uses for the heat sealing machine recently developed by the Sav-Way Industries in cooperation with the Dow Chemical Company are expected to continue in the packaging of industrial parts and instruments, the future, it is predicted, will see its extended application to the packaging of foodstuffs, household items, and articles for export shipment.

The demand for and development of the new process, described and illustrated in detail in this article, is another indication of the increasing importance of plastics in packaging. The need for improved methods of heat sealing thermoplastic films arose in conjunction with a larger problem which manufacturing and packaging companies faced during the war—that of packaging supplies and equipment for shipment overseas so that they would arrive in perfect condition. Making the job all the more difficult was the fact that these war materials had to be protected against possible immersion in salt water, attack by mildew and other fungi, and exposure to temperatures ranging from extreme hot to extreme cold.

Many solutions were found for protective packaging, but one of the most satisfactory was the use of plastics film, particularly vinylidene chloride. Plastics films were important during the war and they now promise to prove

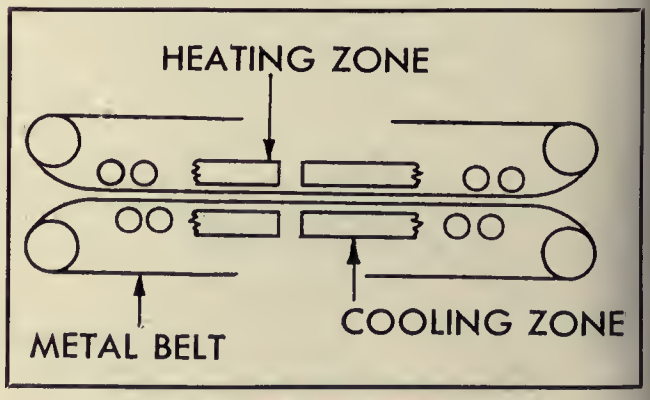

Fig. 1. Entering at left, film is sealed continuously

New device controls pressure, temperature, timing, does away with objectionable shrinkage

even more useful because their many excellent characteristics make them ideal as packaging materials. Among their collective merits are transparency, high bursting strength and resistance to drop impact, low moisture transmission, resistance to chemicals, colorability, flexibility over a wide temperature range, and non-flammability.

But the highly-oriented plastics films used for packaging shrink and become deformed when sealed by ordinary methods. Thus, to achieve a water-proof, smooth, and undistorted weld, the edges of the films to be sealed should be gripped and held in place throughout the complete sealing operation.

The Sav-Way *Sara-Sealer*, developed to handle highly-oriented film with characteristics of high deformation when heated, also operates equally well on all types of plastics film and foil materials.

The new machine, simple in principle, is a combination of the roller and jaw types of heat-sealing machines. The film to be sealed is supported between two thin metal conveyor belts. Fig. 1 shows how this is done mechanically. These metal belts carry the film through consecutive heating and cooling zones before being released. Heat is applied by two opposed heating bars that conduct heat through the metal belts. The cooling zone consists of two opposed cooling bars that immediately follow the heaters.

The film is held by the metal conveyor belts while it is being melted together, and the molten section is thoroughly cooled before being released. This process eliminates the objectionable shrinking and sticking experienced when many other sealing processes are used on thermoplastic films or heat-sealable foils.

The three variables most important to heat sealing—temperature control, pressure adjustment and timing—have all been considered and satisfactorily provided for in this machine.

Probably the most important feature of the *Sara-Sealer* is a sensitive temperature proportioning controller which holds heater bars within ± 1° F, controllable at any tem-

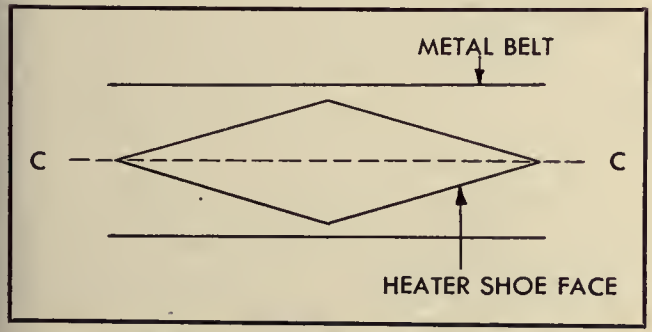

Fig. 2. Heater bar face concentrates heat at weld center

Fig. 3. Of edge or fin type, slip sheet, and lap welds, lap type—regardless of materials—is strongest by far

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Material	Type of Weld	Belt Speed (ft/min)	Tensile Strength (psi) Max.	Avge.	Min
Saran, Type M, 225 gouge	Edge or Fin	15	10.8	7.9	5.5
" " " " "	Edge or Fin	32	9.7	8.3	5.5
" " " " "	Slip Sheet	15	8.5	6.7	4.6
" " " " "	Slip Sheet	32	7.7	6.2	4.2
Pliofilm, avge. thick. 0.0040	Edge	15	8.5	7.0	6.5
" " " "	Slip Sheet	15	7.5	6.7	6.0
Metal Foil	Edge or Fin	25	5.88	5.55	5.06
Koroseal	Edge or Fin	25	7.50	7.20	6.75
"	Edge or Fin	25	14.12	13.70	13.06
Polythene, 1 mil thickness	Edge or Fin	25	1.62	1.48	1.19
" 2 mil "	Edge or Fin	25	2.81	2.65	2.56
" 3 mil "	Edge or Fin	25	4.06	3.86	3.69

perature up to 500° F. This is an electronic control instrument using iron-constantan thermocouples, installed near the heater bar faces. A single pale, double-throw thermocouple switch permits checking of the temperature of either heater bar individually. A rheostat is coupled in series with heater bars to balance out any difference in temperature that may exist.

Pressure adjustment control is another important feature of this machine. The heater bars are so mounted as to be self-aligning, allowing the specially designed shoes to be precision aligned at all times. Means is provided to adjust pressure between the shoes by increasing tension on the springs.

Timing in the *Sara-Sealer* may be accomplished by increasing or decreasing the speed of the metal belt conveyor. This speed may vary from 10 to 38 fpm, depending on the type of film used and the weld desired.

Because of the unique and practical design of the heater bar faces, an excellent heat seal may be obtained on any thermoplastic film or heat-sealable foil by use of the *Sara-Sealer*. Fig. 2 shows the design of the heater bar face of the sealer. This design allows greater heat concentration in the center channel of the weld, and the resultant seal is therefore welded more thoroughly through the middle section than at the outer edges. In this way the weld line straightens, distributing stress lines at equal points on the same plane and tending to increase greatly the efficiency of the weld. This same situation is true with all types of packaging materials tested, as well as with the highly oriented materials such as *Saran*.

In testing the heat-sealing qualities of this machine, three types of welds were checked: the edge or fin type, the slip sheet type, and the lap type (See Fig. 3). Regardless of materials used, lap type seals give approximately twice the strength of the edge or fin types.

Welds made by the *Sara-Sealer* have recorded tensile strength as high as 27 psi. On *Saran, Pliofilm, Koroseal* and *Polythene,* fracture of the materials takes place next to the weld, and only on a scattering of readings was there a parting of the material at the weld. Metal foils usually pull coating and foil away from the paper backing.

In designing this heat-sealing unit, care was taken to make it easily adaptable to a number of different production line methods. Thus, the sealing head of the machine may be tilted in a 90° arc, enabling the operator more easily to seal many different sizes of light packages. This is especially important where packages of varying sizes and shapes are to be heat-sealed.

The same unit head may also be mounted on a monorail to simplify the packaging of large containers. A conveyor type of sealer, using a belt which has been synchronized with the speed of the sealing head, is available where heavier items are to be packaged. END

Plastics in Armor

(*Continued from page* 56)

Bureau of Ships had about 300,000 jackets on order at war's end and had already received delivery on enough for extensive use in island combat in the Pacific.

At the close of the war Westinghouse Electric, U. S. Rubber, Firestone, and Formica Insulation were producing *Doron*. Many other laminators had developed the processing techniques but had not entered production.

Concurrent with the work on glass cloth-resin laminates the Naval Research Laboratories evolved nylon flack armor. This project was sponsored by the Bureau of Aeronautics, and the development work was done in collaboration with the du Pont Company. The object had been in the beginning to find a lighter replacement for bullet-proof glass. First, solid sheets of acetate, methyl methacrylate, and ethyl cellulose were tried, then laminates of oriented nylon film. Laminates of high strength fabrics were experimented with also. Though many of the structures were not transparent and so were ruled out as possible sources of substitute materials for bullet-proof glass, they had good ballistic properties. These various experimental steps led to the development of the nylon body armor.

This consists of many plies of heavy nylon fabric stitched together at about four-inch intervals. Several weaves were tried and subjected to tests. Finally a nylon fabric, designated as NFD 202.1, woven in a two-by-two inch basket weave was chosen, made from a 210/34 yarn of 7 gm per denier strength. Lately a newer, stronger fabric has been made in a four-by-four inch basket weave from 8 gm per denier yarn.

Enough nylon goes into a flexible flak vest to make 432 pairs of stockings. It is made of 32 layers of nylon and weighs about 18 lb. The vest has three pieces: front, back, and apron (attachable to the front). Front and back are clipped together. The vest is tied on, but can be released in a split second by a pull on the tie string. The nylon armor gives just as much protection as the metal armor and is lighter.

Another protection for crew members in planes is flak curtains. These curtains are 24″ by 48″ and are made of 15 layers of nylon, weighing only 10 lb. (Metal ones offering approximately the same protection weigh twice as much.) Enough nylon for 240 pairs of stockings goes into the curtains. Nylon armor does not protect against bullets from rifle, pistol or machine guns, but stops fragments of high explosive projectiles.

Both *Doron* and nylon armor were extensively tested at the Naval Proving Ground, Dahlgreen, Virginia. The most important test was the 20 mm High Explosive Forward Spray Fragment Test, in which a sheet of the material was set up in a panel three feet behind a thin steel sheet. The fired projectile detonated when striking the steel sheet and the fragments flew on the test panel. Another experiment, the so-called Hot-Cold Cycling Test, determined resistance to changes of temperature.

Army Ordnance developed all helmets and body armor used by the Army during the war. More than 22,000,000 steel helmets were procured by the Ordnance Department. These helmets fitted over a laminated plastics liner.

Eighth Air Force flyers were protected almost from the start against flak fragments. In the last war heavy steel suits had been worn, and at the beginning of World War II the Eighth Air Force used a modified form of this suit. It was soon improved, and mass production began. There were developed two standard vests for airmen, made up of overlapping Hadfield manganese steel backed by nylon. One, designed for bombardiers, gunners, and bomber navi-

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gators, is very heavy, weighing 17½ lb. The other weighs only 7¾ lb and is designed for pilots and co-pilots. It protects only the front of the body, the back being protected by armor plate seats.

Army Ordnance tried to find a lighter material for body armor and after a series of tests decided on a combination of nylon and aluminum. The value of armor has always been tested heretofore by obtaining the ballistic limit with a .45 caliber bullet. The material which stopped a bullet at the highest velocity was considered the best. But as pointed out earlier, most battlefield casualties are caused by shell fragments and not by bullets. In the course of extensive war-time development of armor for airmen, a new method of test was developed known as the 20 mm Triangular Fragmentation Test. This test permits the evaluation of the relative merit of armor and armor materials by determining the casualty producing power retained after the shell fragment has penetrated the armor.

Tests were made at the Aberdeen Proving Grounds with an arrangement of three boxes. Each box contained 36 sheets of .020" aluminum, at one-inch intervals. Hadfield steel of known characteristics covered the front of one box while two types of armor plate to be tested covered the other two. A 20 mm high explosive shell was statically detonated in the middle, and fragments were thrown against the test plates and standard control plate. Fragments which penetrate up to six sheets of aluminum cause no casualties; above that number they wound or kill.

By the close of the war, aluminum-nylon had supplanted steel in all standard types of metal body armor. Aluminum-nylon armor for airmen was made in two models of vests and three models of aprons. Three-by-five inch aluminum-alloy plates were laid in overlapping fashion and backed by nylon pads. The nylon pads either arrest the penetrating splinters completely or greatly reduce their momentum. This type of armor offers greater protection at more than 20% less weight than the steel armor.

An aluminium-nylon armor vest for ground troops was standardized and many thousands were produced just prior to the close of the war. It is constructed of aluminum plates backed by nylon pads similarly to the airmen's armor and weighs 12 lb. A small apron weighing 1½ lb and made entirely of nylon is attached to the vest. A jerk on two shoulder straps releases both pieces in an instant. They can be easily folded and carried in a pack.

The suit was meant first for infantry jobs which do not call for great physical exertion, such as those of tank men, drivers of bull-dozers, snipers, etc. The war ended before the infantry suit was used in combat.

None of our enemies used plastics body armor. Of our allies the British had what they called a plastics armor, but it actually was made of steel covered with pitch. END

Comdr. E. L. Corey, human target, stakes "Doron" against .45

Cold Molded Plastics

(Continued from page 52)

designer should know the production required so that he can decide on the type of mold, quality of steel, and the number of cavities per mold. Generally, all cold molded molds are of positive design and semi-automatic in operation because they are fastened in the presses.

The molds are operated at room temperature, about 70° F, and are not designed for heating or cooling as is the case in hot molding. Basically, the molds are composed of a top piston, a bottom piston, and a cavity, all made of hardened tool steel. The top and bottom pistons are usually mounted on cast iron plates. The cavity is inserted in a cast iron housing. The bottom piston is designed to serve as an ejector to remove the piece from the mold. Guide pins are used to keep the working parts of the die in alignment. Many times it is necessary to add a set of cast iron parallels between the bottom plate and housing to provide clearance for the operations of the ejector pad. Pieces with side or cross holes require removable pins, and undercuts are formed by the use of splits.

It is impossible to discuss in detail all the many problems that are met in the manufacturing of various designs in molding. Each individual piece is a separate problem and must be considered accordingly. There are, of course, certain general principles which an experienced designer will know, but even then every new design creates problems that can be solved only by actual experience.

The problem of designing the mold is not only a difficult one, but the actual building of it is an art in itself. The men who make the molds represent a very high class of tool makers. It takes years of actual experience in this class of work to develop the right technique and knowledge to build a good mold. The work must be very accurate, and it often requires an unlimited amount of patience to machine some of the complicated mold parts.

An important factor for consideration is the provision for wear and shrinkage on each dimension so that the molded pieces will measure according to the drawing, and so that the mold will produce a substantial number of satisfactory parts. This requires considerable experience, and only actual practice can be used as a reliable guide.

A poorly made mold is not only troublesome, but very expensive. Good molded parts require good molds. It is best to have the mold and molded parts produced by one company, thus eliminating divided responsibility.

The development of hobbing in recent years has helped the molding industry considerably in reproducing mold cavities quickly and cheaply. Hobbing is to steel what the molding process is to plastics. It is the molding or forming of low carbon steel by means of an extremely hard master hob. The hob is usually made from a very fine grade of alloy steel and must be highly polished, since any imperfections will appear in the hobbed cavity. The pressures used are enormous, ranging from 200,000 to 400,000 psi.

Moldings faithfully show the design and construction of the mold. Generally, the surface finish and parting lines or seams are objectionable. They detract from the appearance of the piece, or present sharp edges which must be removed. It is the custom, however, to produce as nearly as possible a finished part so that machining operations are not required.

Finishing operations can be divided into several processes. First is the removal of burrs or fins either where the mold parts, or around holes and slots molded in the pieces. This is usually accomplished by tumbling the parts in a barrel, with or without sawdust, brushing off the burrs

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INDEX OF Advertisers

Jan. 1946

Advertiser	Advertising Agency	Page
Aaron Machinery Co.		130
Accurata Spring Manufacturing	Russell T. Gray	87
American Die & Tool Corp.		133
American Flange & Mfg. Co. Inc.	Freiwald & Coleman Advertising	24
American Phenolic Corporation	Evans Associates, Inc.	17
American Society of Tool Engineers	St. Claire Advertising Agency	107
Amos Molded Plastics	Sidener and Van Riper, Inc.	28
Arrow Plastics Company	The Powerad Co.	118
Auburn Button Works Incorporated	Charles L. Rumrill & Co.	96
Austin Tool & Mfg. Co.		132
Bamberger, A.	Lea Murray, Advertising	124
Barnes & Reinacke	Behel & Waldia & Briggs	100
Battalen, L. H.	Gunn-Mears Advertising Agency	130
Boonton Molding Company	A. J. Slomanson, Associates, Inc.	16
Bortman Plastics Company	Lawrence F. Dutton	121
Brilhart, Arnold, Ltd.	Henri Le Mothe Agency	4th Cover
Catalin Corporation	Walter J. Gallagher, Advertising	2nd Cover
Celanese Plastics Corporation	Ivey & Ellington, Inc.	39
Cello-Plastic Chemical Co.	H. M. Dittman Advertising	110
Celoid Mfg. Co., Inc.		106
Chemaco Corporation	R. T. O'Connell Company	101
Chicago Molded Products Corporation	Almon Brooks Wilder, Inc.	102
Columbian Rope Company	Barlow Advertising Agency, Inc.	14
Consolidated Molded Products Corporation	Waltar J. Gallaghar, Advertising	63
Continental Can Co., Inc.	Batten, Barton, Durstina & Osborn, Inc.	8
Continantal-Diamond Fibre Company	Harry P. Bridge Co.	81
Continantal Plastics Corporation	Jim Duffy Company	108
C-Thru Ruler Company	Post Johnson & Livingston, Inc.	133
Cumberland Engineering Co.	Richard Thorndike	115
Curtis Manufacturing Company	Oaklaigh R. French & Associates	119
Dafianca Machina Works, Inc.	Beeson-Fallar-Reichart, Inc.	20
Detroit Mold Engineering Company	Charles M. Gray & Associates	117
Dillon, W. C., & Co., Inc.	Merrill Symonds Advertising	118
Dow Chemical Company, The	MacManus, John & Adams, Inc.	21
Durite Plastics Incorporated	Lawrence I. Evarling	25
Dzus Fastener Co., Inc.	Platt-Forbas, Inc.	57
Eagle Signal Corporation	Bawdan Bros., Inc.	113
Eastern Tool Designers		130
Ekstrom, Carlson & Co.	Cummings, Brand & McPherson, Advertising	130
Emeloid Co., Inc., The	United Advertising Agency	13
Engineering Specialties Corporation	Maxon, Inc.	97
Famco Machine Co.	Western Advertising Agency	121
Federal Telephone and Radio Corporation	Marschalk & Pratt Co.	9
Feisanthal, G., & Sons	Lieber Advertising Co.	88
Fenwal Incorporated	Cory Snow, Inc.	89
General Electric Company	Benton & Bowles Inc.	53
General Industries Company, The	Fullar & Smith & Ross, Inc.	47
Gering Products Inc.	M. C. Diedrich	109
Girdler Corporation, The	Roche, Williams & Cleary, Inc.	35
Goodrich, B. F., Chemical Company	The Griswold-Eshleman Company	5
Great American Color Company		129
Greenhut Insulation Co.	Schacter, Fein & Lent	117
Grigolait Company, The	Mace Advertising Agency, Inc.	54
Hawley Products Company	I. A. Feinstein	85
Huntington Stamping & Plastic Co., Inc.		131
Hydraulic Press Manufacturing Co.	The Jay H. Maish Company	3
Ideal Commutator Dresser Co.	VanAuken & Ragland	122
Industrial Conversions, Inc.		43, 99
Interlake Chemical Corporation	Stanley Pflaum Associates	95
International Correspondence Schools	N. W. Ayer & Son, Inc.	128
Johnson City Foundry & Machina Works	L. F. McCarthy and Company	123
Jones, C. Walker, Co.	Gray & Rogars, Advertising	111
Karlstad, Andrew C.		130
Kimberly-Clark Corporation	Foote, Cone & Belding	67
Kingsley Gold Stamping Machine Co.	Continental Advertising Service	127
Kirk, F. J., Molding Company	Cory Snow, Inc.	124
Krieger Color & Chemical Company	Warran P. Fehlman Advertising Co.	116
Kuhn & Jacob Molding & Tool Co.	Eldridge-Northrop, Inc.	104
Kurz-Kasch, Inc.	Kircher, Halton & Collatt	27
Lance Manufacturing Company		59
Lester-Phoenix, Inc.	Ralph Maitland	12
Mack Molding Company, Inc.	George Homer Martin	18
Magnetic Plastics Co., The	Gregory Advertising, Inc.	127
Martindell Molding Company	Eldridge-Northrop, Inc.	112
Midland Die & Engraving Co.	Behel & Waldia & Briggs	93
Minneapolis Plastic Molders, Inc.	Addison Lewis & Associates	69
Mosinee Paper Mills Company	Klau-Van Pietersom-Dunlap Associates	23
National Lock Company	L. W. Ramsay Company	105
National Organ Supply Co.	National Service	126
National Plastic Products Co.	The Joseph A. Wilner Co.	114
National Vulcanized Fibra Co.	John Gilbert Craig Advertising	41
Noma Electric Corporation		132
Pennsylvania Coal Products Company	Lee Murray, Advertising	7
Plaskon Division, Libbey-Owens-Ford Glass Company	Meldrum & Fewsmith Advertising, Inc.	19
Plastic Finishing Corporation		114
Plasticos Mexicanos S. A.		130
Plastics Industries Technical Institute	Beaumont & Hohman Incorporated	125
Plax Corporation	Charles Brunalle	49
Printloid, Inc.	Raiss Advertising	61
Protactiva Coatings, Inc.	Associated Business Counselors	130
Radio Raceptor Company, Inc.	John A. Finnerman	134
Rayon Processing Co. of R. I., Inc.	Richard Thorndike	10
Rohm & Haas Company	Newell-Emmett Co.	70
Royle, John & Sons		91
Shaw Insulator Company	Charles Brunalle	48
Siegal, M. B. Associates	Craig E. Dannison Advertising	128
Silicocks-Miller Company, The	Fred H. Ebersold, Inc.	113
Sossner Steel Stamps	Erlich & Neuwirth	125
Standard Products Co.	Brooke, Smith, French, Dorranca, Inc.	77
Stevenson, H. N., Jr.		128
Stokes, F. J., Machine Co.	McLain Organization, Inc.	45
Stricker Brunhuber Co.	Aldridge-Preston Advertising	120
Taber Instrument Corp.	Malvin F. Hall Advertising	122
Tennessee Eastman Corporation	Fashion Advertising Co., Inc.	33
Taxon Industrial Corp.		128
Union Tool Co.	George T. Metcalf Co.	129
Universal Hydraulic Machinery Company	Gunn-Maars Advertising Agency	128
Universal Plastics Corporation	Cayton, Inc.	15
Valepac, Frad M., Co.	Schactar, Fain & Lent	126
Walkar Goulard Plahn Co.	The House of J. Hayden Twiss	131
Waterbury Companies, Inc.	Manternach, Inc.	6
Watertown Manufacturing Co.	R. T. O'Connell Company	79
Western Shade Cloth Company, The	Hardy Advertising	11
Worcestar Mouldad Plastics Co.	C. Jerry Spaulding, Inc.	3rd Cover
Wrigley, Jr., William Company	Ruthrauff & Ryan, Inc.	94
Yardley Plastics Co.	Byar & Bowman Advertising Agency	75
Ziv Steel & Wire Co.	Vernon S. Wellar, Advertising	120

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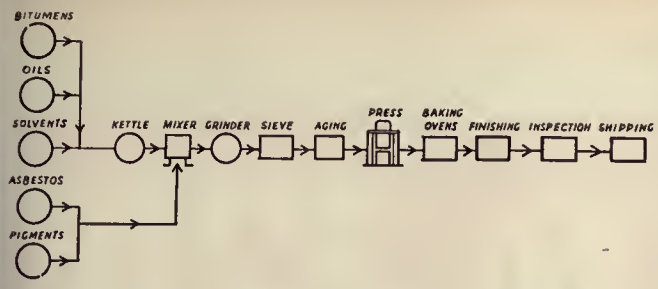

Steps in Cold Molding

with a high-speed revolving wire brush, or drilling the burrs at the holes. An improved surface finish can then be accomplished by sanding and polishing the parts.

The sanding operation is done with either a revolving felt wheel covered with a fine surface of carborundum powder, or a sanding belt. The piece is held against the wheel or belt and the surface is ground to a smooth finish.

The polishing operation is accomplished on a soft linen wheel about 10" in diameter, revolving at a speed of about 1750 rpm. The surface of the wheel is coated with a light film of a polishing compound such as wax, or a special preparation made by the manufacturer.

Molded parts can be easily ground flat on mating surfaces, but drilling, tapping, and machining operations are very difficult because the material quickly dulls the cutting edges of the tools. These are usually made from glass, diamonds, or metallic carbides such as carboloy. Ordinary steel tools, even if chromium plated or covered with stellite, are soon rendered useless, and their life is extremely short.

As in molding, so in finishing, each design has its own problems, and a satisfactory answer is found only by the long experience gained in the manufacture of similar articles. Costly fixtures may sometimes help, but such expenses must be kept at a minimum because on short runs they would greatly increase the cost of the molded parts.

One of the most important obligations of any molder, often sadly neglected or completely omitted, is inspection of the final product. The problem of inspection is a two-fold responsibility divided between molder and customer.

It is the customer's duty to furnish complete information enabling the manufacturer to set up an inspection procedure to guide him in his manufacturing operations. This information should include important dimensions, with tolerances specified, surface finish, and physical and electrical properties, as well as the manner in which the piece is going to be used. If the customer has developed a special test for the molded parts, the manufacturer should duplicate it in his plant, and keep a record of his results.

The molder should establish an inspection procedure based on the information given by the customer, and examine all parts accordingly before they are shipped. Inspection can be done by properly trained personnel. END

Properties of Typical Compounds of Cold Molded Material

Property or Constituent	Aico No. 1 and No. 6	Aico No. 5
Binder	Asphalt and phenolic	Cement
Filler	Asbestos	Asbestos
Color	Black or brown	Gray white
Finish	Good	Poor
Specific gravity	2.0	2.3
Tensile strength (psi)	1,500—2,000	500—600
Compressive strength (psi)	6,000—15,000	16,000
Flexural strength (psi)	3,700—9,300	1,400—4,700
Transverse strength (psi)	3,700—4,000	5,000—8,000
Impact strength (ft lb per in. of notch ½" by ¼" notched bar—Izod test)	0.4	0.4
Dielectric strength (vpm)	50—100—140	40—80
Water absorption (% per 24 hr)	0.6—7.5	0.5—26
Heat resistance (°F)	500—600	1,000

Aico in table is a trade name of the American Insulator Corporation

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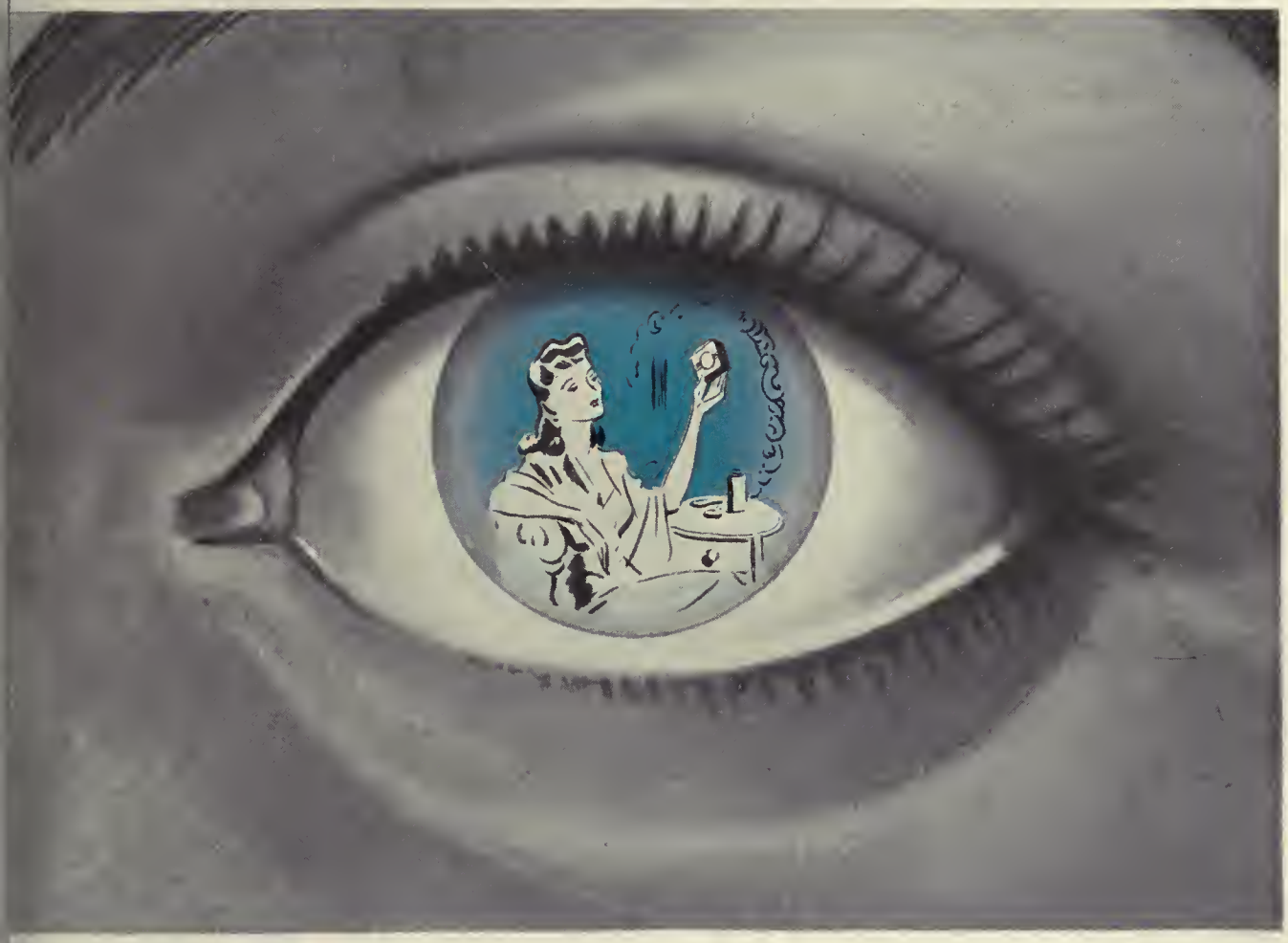

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EBRUARY
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plastics

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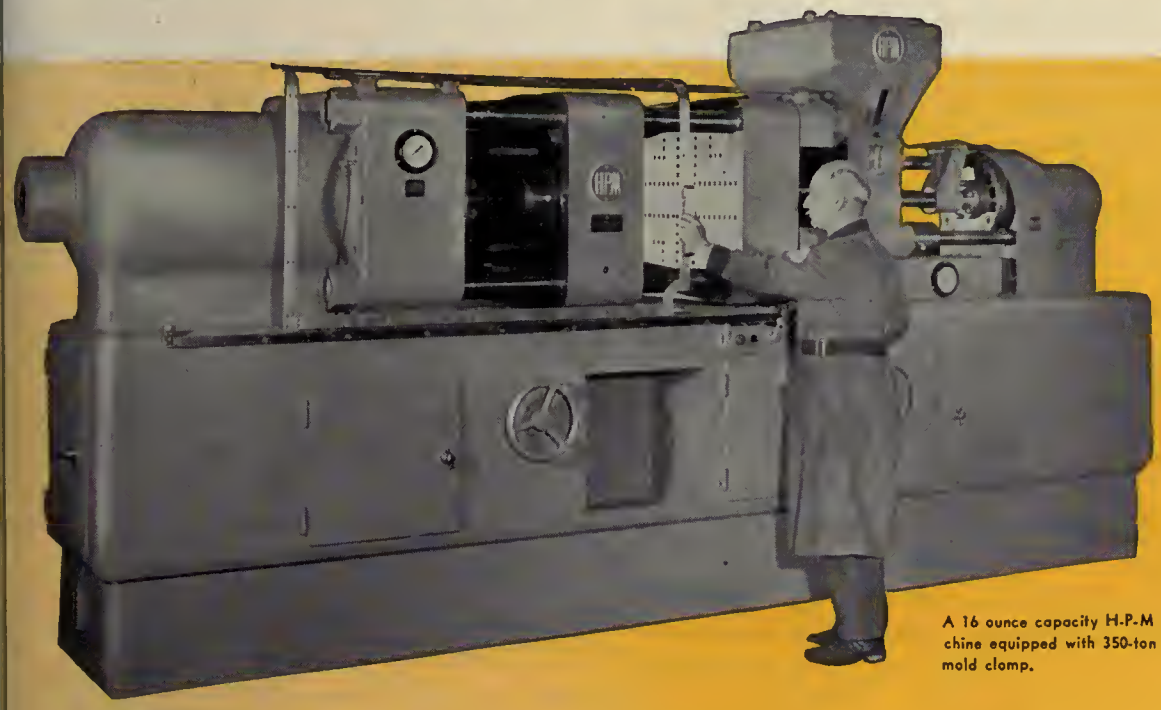
This sink strainer, molded by Vichek Tool Company with a 9-ounce H-P-M injection machine, is a typical thermoplastic molding. Total weight of shot—4¾ ozs.; average thickness—.075"; production per hour—70; material—cellulose acetate.

FOR Injection Molding OF THERMO-PLASTIC RESINS



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FEBRUARY, 1946

plastics

VOLUME 4, NUMBER 2

in this issue

New Vistas for Hats ..... *Louise Sanders* 23
Casting Phenolics in Phenolic Molds ..... *Jack D. Stratton* 26
Know Your Butyrates ..... *Spencer E. Palmer* 32
Old Titles in New Jackets ..... *M. L. Stephen* 38
Where Are the Materials? ..... *William Schack* 40
Engineering for Spring Tension Fasteners 48
Molding Acrylics 52
Machining Polystyrene ..... *Mel Meyers* 56
Protecting Electronic Equipment from Fungi ..... *Philip Pollack* 60
Plastics in Boats ..... *Houlder Hudgins* 64
New Motifs in Lampshades 68
Acrylics Go to Court ..... *Phil Buskirk* 72
Selling the Hobbyist ..... *Margarita Dobert* 74
Pot Design for Transfer Molds ..... *T. N. Willcox* 92
SPE Convention and Exhibit 102

departments

Plastics in Perspective 20
Plastics at Work 46
On the Drafting Board 67
Engineering News Letter 70
What's New in Plastics? 79
Literature Review 80
Problems in Plastics 83
Industry Highlights 84
People 86
Association Activities 88

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COVER

Removing and finishing gates on lipstick containers by Nash automatic flash lathe at the plant of the Chicago Molded Products Corporation. Photograph by Arthur E. Haug.

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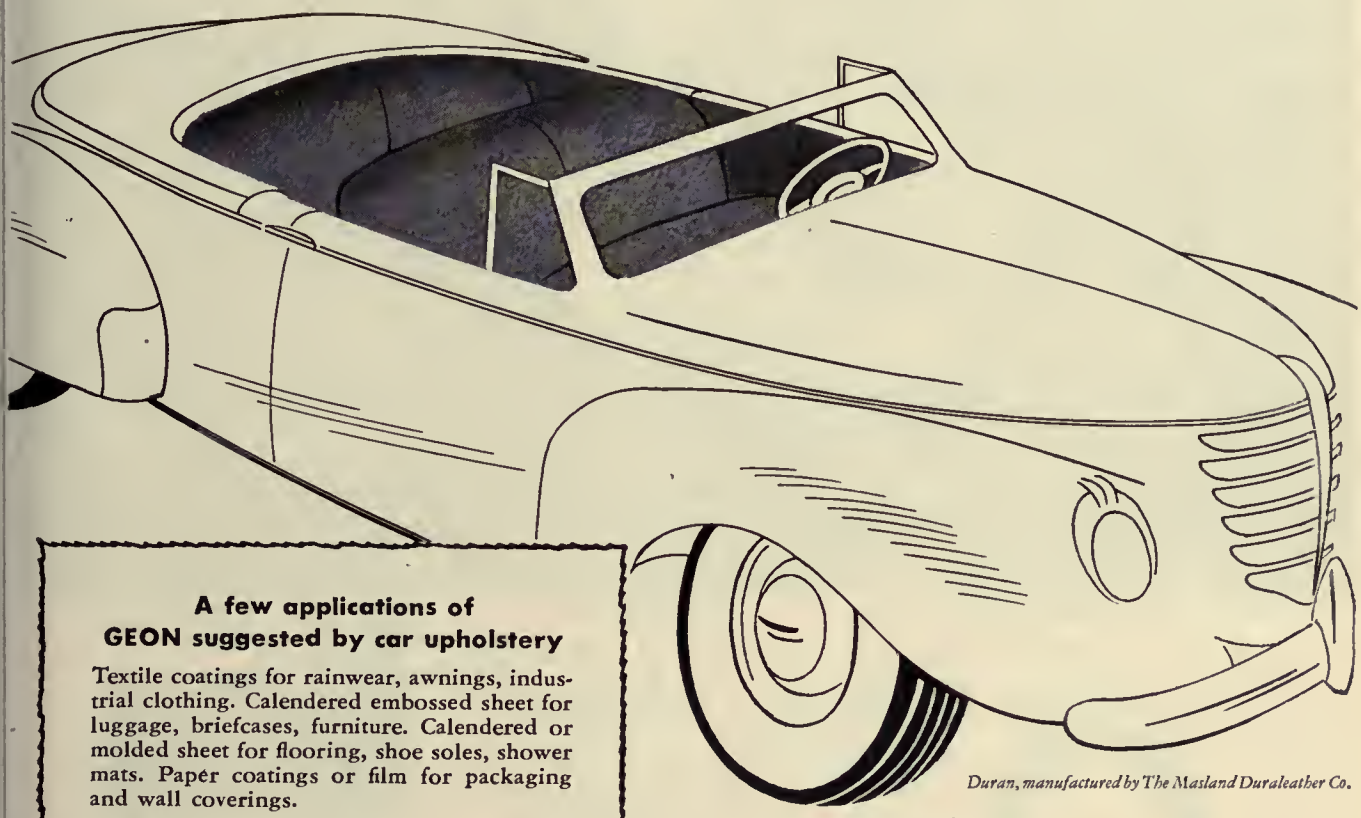

Duran, manufactured by The Masland Duraleather Co.

A few applications of GEON suggested by car upholstery

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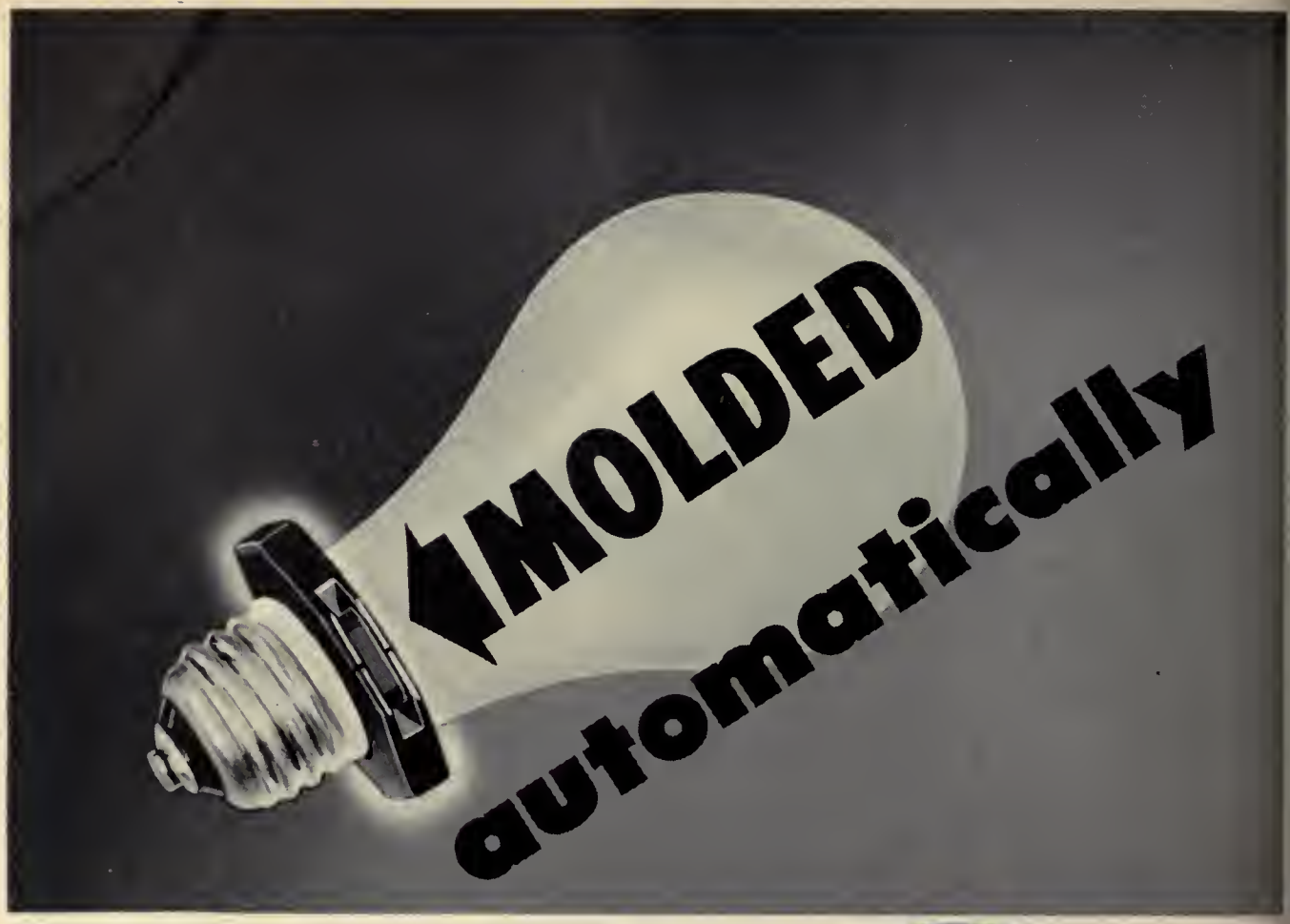

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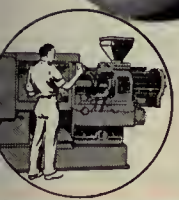
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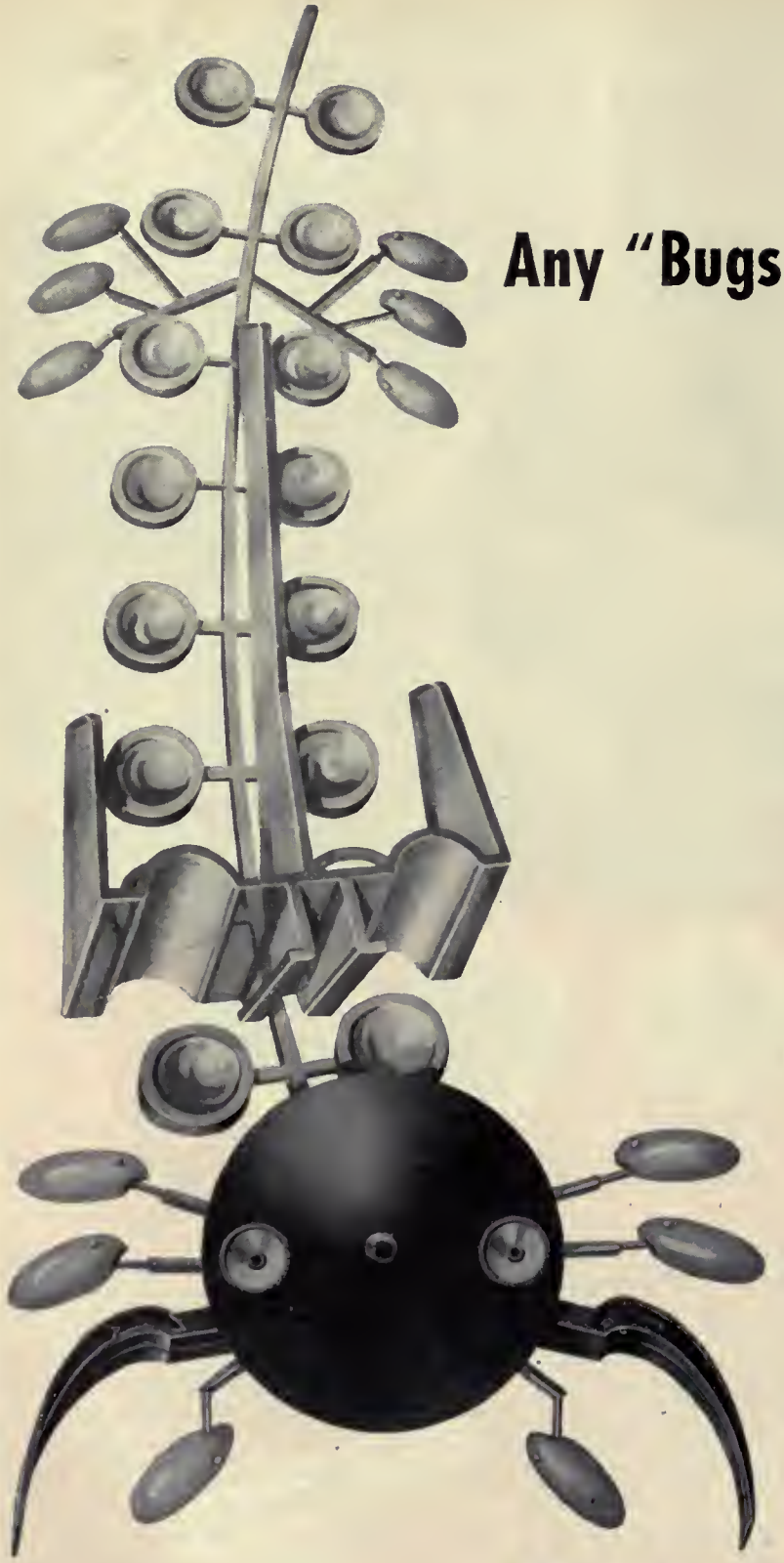

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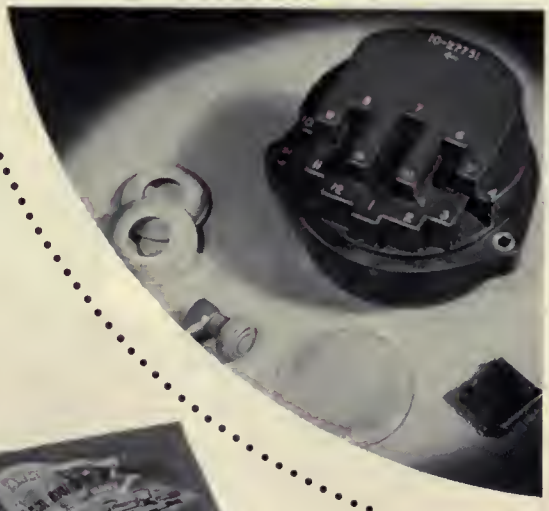

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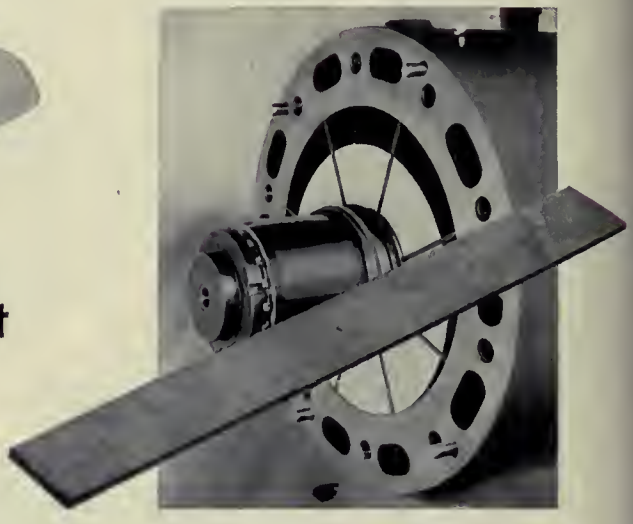

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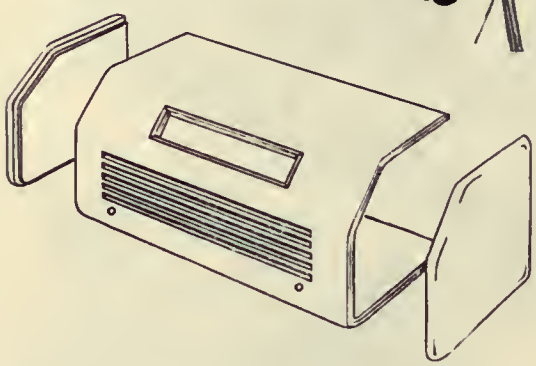

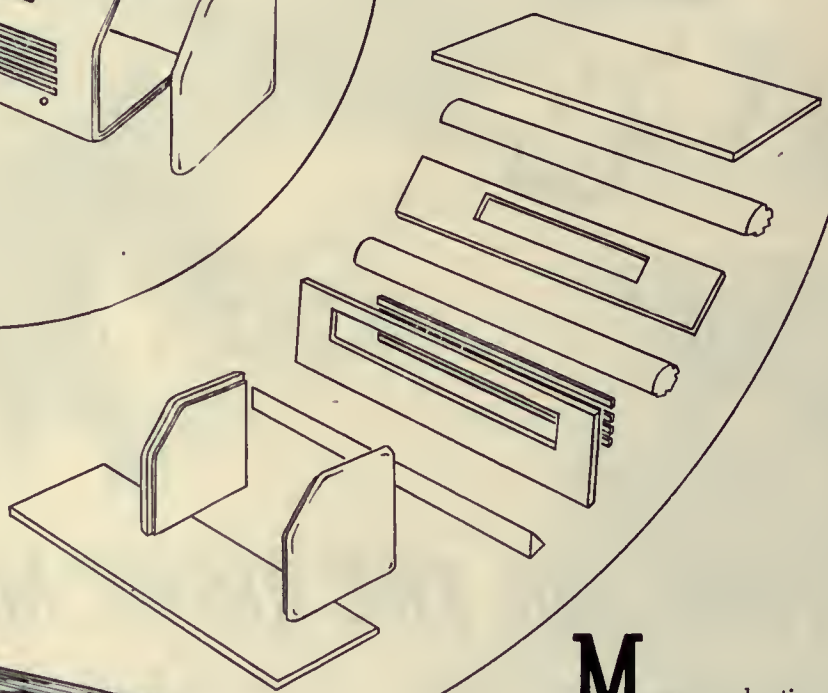

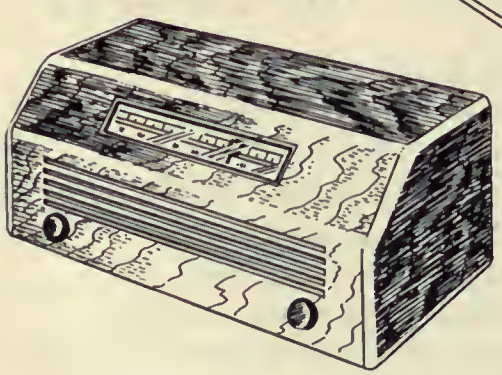

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PLASTICS in PERSPECTIVE.....

WHEN at the close of the war plastics materials were not immediately forthcoming in satisfactory quantities, everyone ascribed the reason to the pains of reconversion. But instead of improving in the succeeding few months as expected, the situation worsened, and the *why's* and *what's the matter's* swelled into a thundering chorus. Buyers, hopeful of marked relief, found materials continuing tight, and began looking for a "villain." There is no one "villain," of course, the reasons for shortages being almost as numerous and diverse as the shortages themselves. A matter of far more consequence to the buyer, anyway, is when he can find ample materials supplies to fill all demands. In this respect, two articles and a talk are of interest.

The Plastics Materials Manufacturers Association report, published in last month's **plastics**, gives a generally optimistic view of the availability of materials in 1946, although cautioning that completion dates of new facilities "depend upon building material supply, building labor, and the ability of the equipment manufacturers to turn out special types of equipment required in a reasonable time." "Barring unforeseen delays," the report continues, "many of the expansion programs will become effective in the spring of 1946 and thereafter through the middle of 1947." Among the causes cited for previous and current shortages are insufficient labor and a lack of processing equipment.

In this issue, the article "Where Are the Materials?" supplements the report in the January issue. It goes further in that it presents direct statements by various leading materials suppliers concerning extent of shortages, reasons for shortages, and plans for increasing the availability of materials. Like the PMMA report, it predicts increasing supplies throughout 1946 and into 1947.

In a talk on December 20 before the Chicago group of the Society of the Plastics Industry, William Cruse, SPI secretary, in touching on the subject of materials, struck the same general tone of cautious optimism.

Out of these various studies and observations, one crystal clear fact emerges: The materials suppliers are bending every effort to increase production, and scarcities will vanish one by one during the current year.

* * *

CALCULATED to standardize procedures in the determination of volatile contents and flow of laminating materials, two test methods recently released to the plastics industry by the Laminating Activities Committee of the Society of Plastics Engineers represent an important step toward further standardization of procedures in plastics testing.

Drawn up tentatively last April, the tests were subsequently submitted to producers of laminates and impregnated fibrous materials and to users of such products. An accompanying questionnaire sounded out the industry on the desirability of standardization and asked for data on current test procedures.

When the returns were in, the Committee revised the test procedures to line up as closely as possible with what appeared from the questionnaires to be general usage in the industry. The result seems to be two effective, yet simple tests.

The wide co-operation leading to the formulation of these two tests, known as SPE—100—M for determination of volatile content, and SPE—101—M for determination of flow properties, augurs well for future co-operative efforts of the laminating industry. With this auspicious beginning, the way has been opened for the development of further tests.

* * *

A RECENT issue of a national news magazine referred to the claim of a "top automotive executive" that a 1947 possibility is a rear-engine passenger automobile having, among other revolutionary changes, a "glass or fiber plastics body with an impact strength several times that of steel." To those of us who saw the *Fiberglas* cloth-reinforced automobile fender and hood at the SPE Exhibit in Detroit early in January, the prediction of the automobile makes a lot of sense.

But the general claim of an impact strength several times that of steel is so unqualified that it must be questioned. For instance, is it meant that a reinforced plastics piece has several times the impact strength of an equally-dimensioned piece of steel? Or does it mean that it has several times the impact strength of a piece of steel of equal weight? What is considered the failing point of steel in the comparison—the point at which it is deformed or the point at which it gives way completely? We warrant that the engineers working with the new reinforced plastics would carefully state all qualifications and all test conditions in drawing strength comparisons with the metals.

We are willing to go along with the statement that the new material has a higher strength-weight ratio than steel, based on what we know of *Doron*, a reinforced plastics body armor developed in World War II (see **plastics**, January, 1946), but we think that the unqualified statement "several times the impact strength of steel" represents the kind of overstatement and loose statement which we in the plastics industry should rigorously avoid. END

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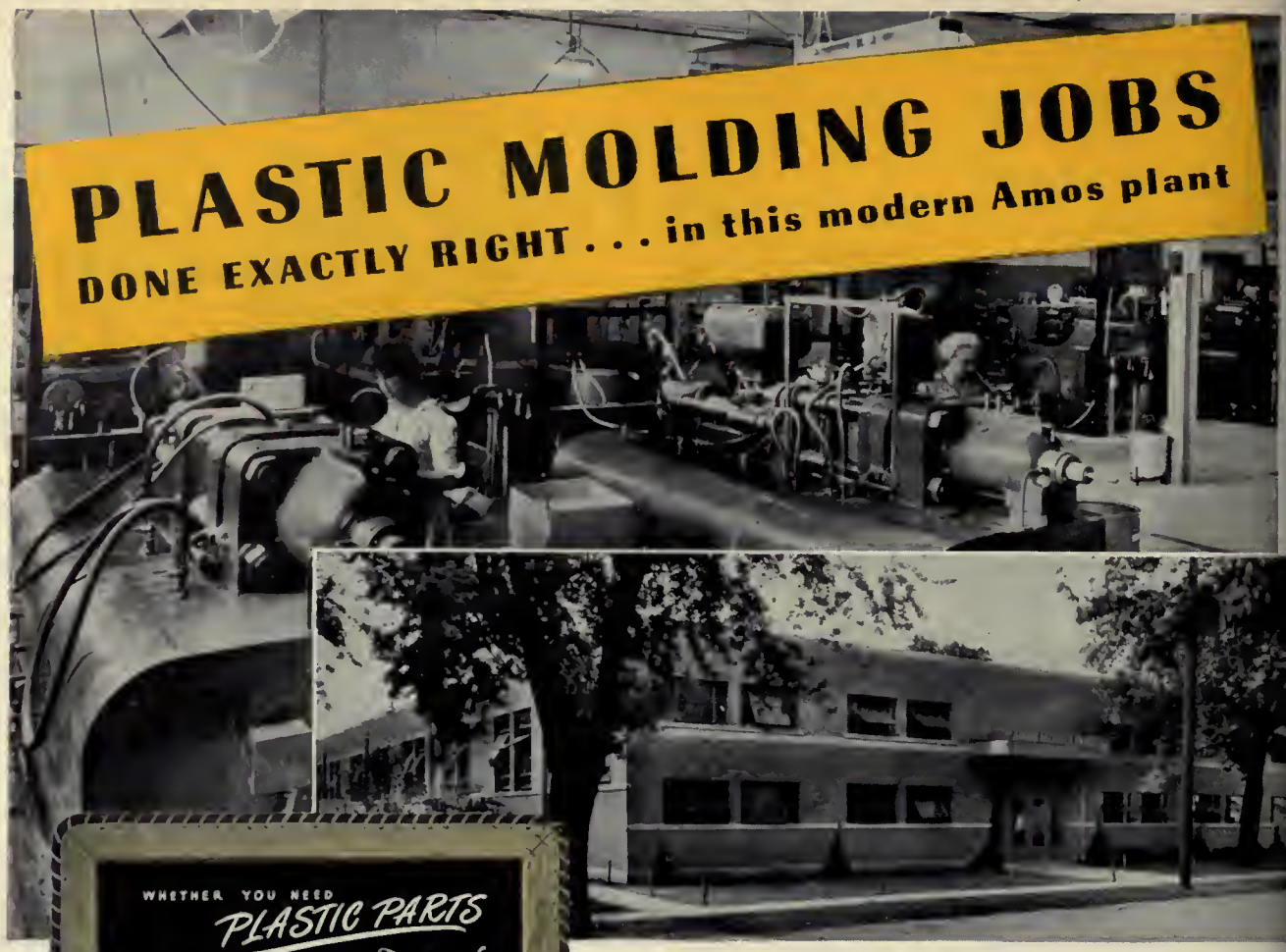

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By Louise Sanders
Product Designer

PLASTICS are a "natural" in the field of fashions by virtue of their eye and touch appeal. As long ago as 1937, when I introduced plastics into the millinery and accessory fields, they found a ready acceptance. Even at that early date, every one of my customers bought at least one plastics hat, along with those made of traditional materials, for a season's outfit. Remember, plastics were then new and revolutionary materials. That they should be welcomed so unquestioningly, that they should find a place beside the traditional materials, the "best families," so to speak, made me ask myself, "What aside from their obvious attractiveness makes them click?" The answer was, and must be, for all designing and manufacturing—"the correct choice of the raw material."

There have been many grievous misapplications of plastics in, for example,

A new glitter in after-dark frippery is introduced by John Frederics in the new sparkling "Plexiglas" hat shown in the pictures on this page. Veil may be completely changed to vary effect, hat may be turned, other variations may be made

New Vistas for HATS

Eye and touch appeal join light weight, washability, softness, freshness, and clarity to make plastics ideal for fashion field

There are, of course, traditional requirements in properties of raw materials in every industry. In fashions, the special requirements are softness, pliability, drapability, and the capacity for easy manipulation. Here the very special taboo is weight, for no matter how novel or striking the item may be, if it's heavy its chances for success are slim. Weight, bulkiness, and rigidity in apparel and accessory fields meet with resistance from the modern shopper, and in many fashion items a revision in styling and materials should be made in the light of these considerations. There is the hand-bag, for example, made of heavy coated fabric or topped by a heavy frame and further burdened by its contents—an over-sized compact more suitable for a boudoir, weighty cigarette case, lipstick container, comb, and countless other feminine necessities that clutter the average handbag. Added to all this are incidental ornamentations of dress, such as buckles, closures, costume jewelry and belts, and, crowning these, a top-heavy bit of millinery—all in all, a formidable load for milady to carry without an extra dosage of vitamins.

Because plastics are so widely diversified in appearance and performance and possess so many varied characteristics, it should not be too difficult to find one which will properly fulfill fashion requirements. But it will be the responsibility

In Sketch No. 1 above, the small feather-cut motifs made of cellulose acetate sheets are said to be first application of this plastics to fashions. At right, Sketch No. 2 pictures a visor-brimmed "beach hat" of colorful cellulose acetate sheet material formed over one-piece hat block

the novelty and housewares fields, and unless proper consideration is given to the choice of the plastics, fashions will not be exempted. Already there are people particularly eager to apply plastics to the many branches of the fashion industry. They come equipped with only a smattering of plastics know-how and seize upon the first raw material that comes to hand without regard to its ultimate suitability or proper function. Consequently, another brand new crop of misfits may flood the market.

Few materials lend themselves as readily to creative work as do plastics—both alone and in combination with other materials. In fashions, particularly, there is a constant demand for inspirational materials because of seasonal and whimsical changes in style. Because plastics fit in so well with style requirements, however, it is likely that they will remain permanently in the fashion field as invaluable adjuncts to other materials.

the designer and fabricator to choose properly from this bundance of excellent materials. As I said before, rigidity nd weight are a menace, and fabrics should be selected hich will yield to the designer's fingers with easy grace. n occasion the more rigid types can be used if clever meth-ls of fabrication are employed.

My sketches show hats designed for the types of plastics ccepted by discriminating hat buyers as the easiest to use millinery and accessories. Foremost among these types re the extruded plastics, for example, extruded *Tenite II* cellulose acetate butyrate) in the form of a fine monofil ot more than 0.0025″ in diameter. This is as pliable and asy to use as a strand of silk. Its great advantage over ther extrusions for millinery use is its extremely light eight. Bright, smooth-textured, and resilient, this plas-cs lends itself to many different methods of fabrication. is supplied in crystal clear as well as a wide range of ewel-toned colors. Another attractive feature is its prop-rty of keeping fresh and crisp looking indefinitely. It does ot soil easily, but when it does become a bit cloudy or lmy after a length of time, it can be restored to its pristine reshness simply by swishing the plastics part in soap suds, nsing it in clear water, and then drying.

The war years put an end to development along these lines, but now the time is here again to exploit some of the wonderful possibilities of plastics in fashions.

Sketch No. 1 shows a small velvet or felt hat trimmed with small feather-cut motifs made of cellulose acetate sheet —the first use of this material in plastics fashions.

This chic visor-brimmed "beach hat" (Sketch No. 2) is made of cellulose acetate sheet material in all the luscious summer shades and formed over a one-piece hat block. The deep half brim which shades the eyes from the sun, continues into the raised crown, which doubles back at a smart height to fit snugly down over the back of the head. Both the lower back part of the crown and the lower front section are provided with slots through which the soft rib-bon or fabric headsize band pulls softly and comfortably over the hair and keeps the hat firmly on the head. It ter-minates on top of the brim into a trim, jaunty bow. These headsize bands are adjustable, and can be changed to match beach togs or spectator sports wear.

In Sketch No. 3, the large hat, never out of style, and a Palm Beach and mid-summer perennial, has in this instance a hat body either machine- or hand-made of extruded *Tenite II* in an all-over conventional patterned lace. This body is manipulated in quite the same way as any other millinery

(*Continued on page* 97)

Sketch No. 3, a Palm Beach and mid-summer perennial, is made of extruded "Tenite II" fashioned into a conventional pattern lace. Below (Sketch No. 4) the large capeline may be fabricated or, preferably, molded into the classic shape illustrated. Scarf at right is composed of fine lace-like extrusions patterned with delicacy and charm

Mock-up (lower right) of improved design of phenolic radio case, made after study and tests of initial prototype (not shown), was formed by phenolic mold sections at top. At lower left is shown the solid wood male pattern used to make first prototype

Casting Phenolics in Phenolic Molds

By Jack Stratton

INDUSTRY has at long last been able to eliminate the high cost and excessive time entailed in making molds, jigs, various other tools, and experimental models of new products. Answer to the problem is phenol-formaldehyde coupled with a number of new casting developments which, together with technical "know how," already has cut costs, increased fabrication speeds, and eliminated most of the post-cast machining. Plus these advantages, a precision product is delivered.

In the short period since their development, phenolic molds have proved practical and economical for casting runs ranging from two to 2000 items, designed either for consumer use or as prototypes.

Exemplifying the economy of phenolic casting, a tabulation of seven jobs recently performed by the Rezolin Company, Beverly Hills, Calif., showed that estimated costs for dies fabricated in metal would have totalled $20,100. Molds made of phenol-formaldehyde for the same work totalled only $1155, effecting a saving of 94¼%.

Expediting production was another advantage. Eight hours on the average was required for fabrication of each phenolic mold in those cases where the designer furnished

An assortment of phenolic articles made in phenolic molds

Showing (left to right) improvements in prototype design

Tenite radio case molded by Worcester Moulded Plastics Co. for Emerson Radio and Phonograph Corp.

Following a well-established tradition, lightweight Tenite encases the first of the postwar pocket radios. Tenite has been used on virtually every make of radio — for cases such as this one, for grilles, dials, and knobs, where features of beauty and durability are important.

Tenite is practically unbreakable. It is available in any color, is permanently lustrous and warm to the touch. Molded at the fastest speeds possible with plastics, Tenite parts are mass-produced in a minimum of time and at relatively low cost.

To obtain further information about the many uses of Tenite plastic, write to TENNESSEE EASTMAN CORPORATION (Subsidiary of the Eastman Kodak Company), KINGSPORT, TENNESSEE.

Tenite

AN EASTMAN PLASTIC

Casting a press mold with which to shape acrylic sheets

Mixing phenolic resin, stabilizing ingredients, catalyst

a properly constructed prototype pattern. Obviously, additional time was required for construeting plaster patterns from drawings.

Dies fabricated in phenol-formaldehyde also have demonstrated their dimensional stability and long-wear quality in press-forming laminated plywood and various plasties sheets, as well as in stretch-forming aluminum sheets in the aircraft industry.

Furthermore, the utilization of phenol-formaldehyde for easting in dies of the same material is enabling manufaeturing industries to supply themselves with large quantities of low-eost prototypes for tests in faetories and for visual showings in the mercantile field.

Both the production of phenolie molds and the casting of phenolie prototypes, as praeticed by Rezolin, involve proeedures around whieh some professional secreey is understandably maintained. Otherwise, the work has been redueed to an interesting technical simplicity.

In fabricating a phenolic mold, frequently produeed in eircular or oval exterior shape, eurved sheet metal—the ends brought together by a elamp—usually is applied as the vertical retaining wall of the form. Window glass, braeed into position, sometimes is utilized for the same purpose in pouring dies for press work.

Special Coating

A phenolie bed, grooved for retention of the pattern, then is installed upon a sheet of window glass beneath the retaining walls, and the pattern is inserted in the groove. Next eomes a strategic part of the operation. All exposed surfaees of the pattern and bed are eoated with a speeial lubricant developed by Rezolin to prevent adherence of the resin during its eure. Apertures around the hed and in walls of the mold are filled with glazier's putty to avoid leaks.

When this make-ready is eompleted, phenolie resin is eompounded in a Hobart mixing maehine with essential aeeompanying ingredients, a step to insure dimensional stability of the die. Mixing time varies from 15 min with approximately 12 lb of material, to 30 min with loads up to 75 lb.

In pouring the mold, care is taken to furnish ample opportunity for air bubbles to escape. Two to three hours then is given for the first seetion of the mold to eure at room temperature.

When the seetion has hardened thoroughly, it is inverted, and used as the bed for the ensuing operation—pouring of the upper mold segment. Retaining walls are extended to the necessary height. The faee of the eompleted mold seetion and the pattern are treated to a second coating of adhesion-preventing lubricant, and the resin is then poured.

After two to three hours of eure, the form is broken away and the eavities are inspeeted. However, approximately two more hours is allowed before the mold is used in easting.

While many pattern materials are used, phenolic-formaldehyde and brass have established the best toleranees. Steel and plaster are slightly less dependable. Aluminum and wood invite discrepancies.

Phenolie tools, such as jigs for drill, saw, and router operations in heavy industry, and nest blocks for presses, have been fabricated for many applieations in mass production. These tools, invariably produeed more eeonomieally and rapidly in plasties than in metal, are doing preeision work after months of strenuous service. Time estimated for fabrieating one drill jig in metal was 250 hr, while its actual easting in phenol-formaldehyde took only 146 hr.

Press forms for plastics and plywood sheets are east analogous to the phenolie molds. Heated wax sheets, following immersion in water, are affixed by hand pressure and shaped to male plaster patterns to provide the skin-thiekness needed for toleranee. All wax surfaees are air-dried to avoid formation of blisters during the easting. As a preeaution to avoid disturbing the wax, the resin for the press form invariably is poured at room temperature.

Out af this huge mold comes a record player cabinet* that measures 16¾ x 14¾ x 6¾ inches. Even without its separately malded caver, this cabinet weighs 5.2 paunds.

Observe how this massive block af taal steel has been machined with micrametric precision. Natice how the mirror finish of the mold is reflected in the high polish af the molded piece, so attractive to the eye and ta the touch.

It takes a good deal of equipment and skill ta make a mold af this size. On the molding press, cansiderable production "know-haw" is required to praduce malded parts that are free fram internal weakness or surface flaws. Here at MOLDED PRODUCTS we have the equipment . . . tagether with the necessary skill and experience. Submit your plastics problem or product to: MOLDED PRODUCTS CORPORATION, 4533 W. Harrison St., Chicaga 24, Illinois.

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PLASTICS DIVISION
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Large stretch-form dies for aluminum sheets involve use of a wooden core to reduce the weight of the tool and to conserve plastics materials.

Fabrication time of such a die, 13 ft long with a coat of 1½ in. of phenol-formaldehyde upon the wood, was 110 hr, including construction of the plaster pattern, setting of the plaster, application of the resin, breakaway of the mold, and the clean-up. Engineers estimated production of a similarly proportioned die in metal would require 200 hr.

Estimated wages for the job in steel were $700. In addition, the producer would have collected for the metal and would have added his own profit. By comparison, the phenol-formaldehyde and wood stretch-form die cost $600.

Scratching Eliminated

But economy of fabrication was not the only factor favoring the plastics die. The tool, now used in Douglas Aircraft's Santa Monica plant, has eliminated the danger of scratching aluminum sheets, always a hazard with a metal stretch-form device, despite the usual precaution of greasing the steel surface. Production is expedited considerably, for greasing and de-greasing operations are needless. In addition, the tool possesses endurance, and presents a hard, smooth surface, which may be depended upon for unlimited production.

Phenolic duplicating patterns to be applied in cutting steel molds for mass compression or injection production likewise have proved their superiority. Cast in phenol-formaldehyde, these patterns present a resistance to the tracing finger of the cutting tool, which eliminates scratches or fractures, frequently experienced with wood or plaster shapes. The plastics duplicating shape also possesses a well-defined detail easily followed by the tool's guide finger, another assurance of close tolerances.

Great strides likewise have been made in sand casting with phenolic patterns. The glossy surface of the plastics shape offers little chance for sand to cling to it when the pattern is withdrawn from the impression.

With economical, speedily fabricated phenolic molds now available, manufacturers are ordering prototypes in larger numbers and are applying them for expanded testing purposes and for a growing number of visual demonstrations.

Here is an instance: The technical staff of a radio manufacturer developed an innovation in cabinets. A solid wooden block, tooled and hand carved externally, served as the pattern, and a uniform thickness was specified for the cabinet material.

The wooden block was used in casting the female phenolic mold. A solid male block was cast in the same plastics and trimmed down to afford the tolerance necessary for the specified thickness. All of this work was performed in 8 hr at a cost of $300, as compared with much greater time and an estimated $3000 for the same operation in metal.

Fifty prototypes in a rich brown blended into the natural phenol-formaldehyde tan were delivered at $3 each, a total of $150. Thus, production of the mold and the cabinets for testing purposes cost $450.

Sound engineers at once began experiments to ascertain the acoustical properties. Technicians studied physical aspects to determine stress points and the suitability of the cabinet to the usual radio hook-up. Designers applied several widely-varying color schemes to many of the prototypes.

The sales force demonstrated the colorfully painted but otherwise identical cabinet prototypes to the trade to determine saleability based on eye appeal. While the cabinets were displayed in the stores, considerable consumer reaction also was observed.

As a result of the investigation, several changes were ordered. The cabinet was redesigned and given greater elevation and a more shapely dome. A mock-up was built from a prototype by the radio engineers, and another 50 prototypes were cast, to be subjected to further trials.

For the second prototype, cost of mold production was $220, a saving of $80 as compared with the original job. This economy was effected because, the mock-up being a

Resin is cold-poured into toy-plane mold heated to 200° F

Then upper mold segment is put on and filling completed

hollow shell, trimming the male mold for tolerances was eliminated.

Whether the radio firm will adopt or redesign the second model hinges upon information now being assembled. Possibly another prototype will be produced, but the point is that the use of phenolic molds has provided the radio manufacturer with a relatively low-cost opportunity to continue his research for as long as he desires.

Once the model is determined, mass production is scheduled on so extensive a scale that undoubtedly metal will be used as the die material. However, the metal die will be made from a duplicating pattern fabricated in a resin of such hard thermosetting characteristics that the error factor in tooling will become insignificant.

Some weeks ago a potentiometer coil frame for military purposes was designed by a precision instrument engineer. The pattern measured 4½ in. in its greatest diameter, had five grooves for fittings, and 19 rectangular and circular holes, ranging from 1/16 to ⅛ in., all to be cast around a brass insert.

The building of a special bed to eliminate tolerances in the numerous surfaces, grooves, and pinholes, and the insertion of metal pins in the mold to effect the necessary 19 perforations took 4 hr, making a total of 12 hr for construction of the phenolic mold.

Mold Economies

Despite this precision operation, the job of mold building was done for $80, as against an estimated cost of $1850 for the same dies in metal. Forty prototypes, billed at $1 each, were cast in phenol-formaldehyde for study by the design engineers.

Tests prompted the design engineers to insert several concentric metal rings, which presented a neat geometrical problem. They rearranged the 19 pinholes and added several grooves for attachments.

Experience with the part had been gained by Rezolin when the original prototype mold was produced. The specially built bed could be used again. This time the die was finished and ready for production in 8 hr, and the cost of the operation was cut to $65.

Production of an eight-part assembly, the prototype for a gun handle on a Lockheed P-80, involved high precision. Estimated cost for steel dies was $4200, but the phenol-formaldehyde molds were produced for $360. Three hundred assemblies were cast, the price for each $4.60.

Jobs handled by this firm include the casting of prototypes for model planes, small aircraft parts, battery boxes, tool and instrument handles, electrical fittings, housings, knobs, gears, distributor adapters, air hose control handles, camera cases, ornamented perfumery flasks, and countless plastics and metal objects.

Solving Molding Problems

Vapor-tight valves, undercuts and threaded contacts present no great engineering problems. Undercuts are accomplished by split molds as in metal die casting. Threaded contacts are made with a fidelity equal to that of compression molding, through use of phenolic inserts. Leak-proof liquid containers, with screw tops, frequently are cast in the plastics molds.

Considerable casting in phenolic molds is done in veined or solid color. One recent solid color job was a line of clothes pins, pigmented in yellow, green, blue, pink, maroon, and black.

The pins, consisting of two plastics parts held face-to-face by a metal spring, were cast in a multiple cavity mold, eight parts, four pins, at a time. Cost of the mold was $60, against an estimated $4700 for a steel die, similarly designed.

Addition of dimensional stabilizing ingredients to the phenolic resin used in making the molds has permitted 2000 casting operations in one mold before deterioration became apparent. Sometimes for mass production of commercial items, mechanical parts, and small tools, it has been

(*Continued on page* 90)

Cured cast of plane is ejected by pin in pouring vent

With flash removed, plane awaits finishing operations

Know Your

BUTYRATES

By Spencer E. Palmer
Sales Manager, Cellulose Products Div.,
Tennessee Eastman Corp.

Form retention, beauty, strength, and toughness explain use of cellulose acetate butyrate for many molded, extruded articles

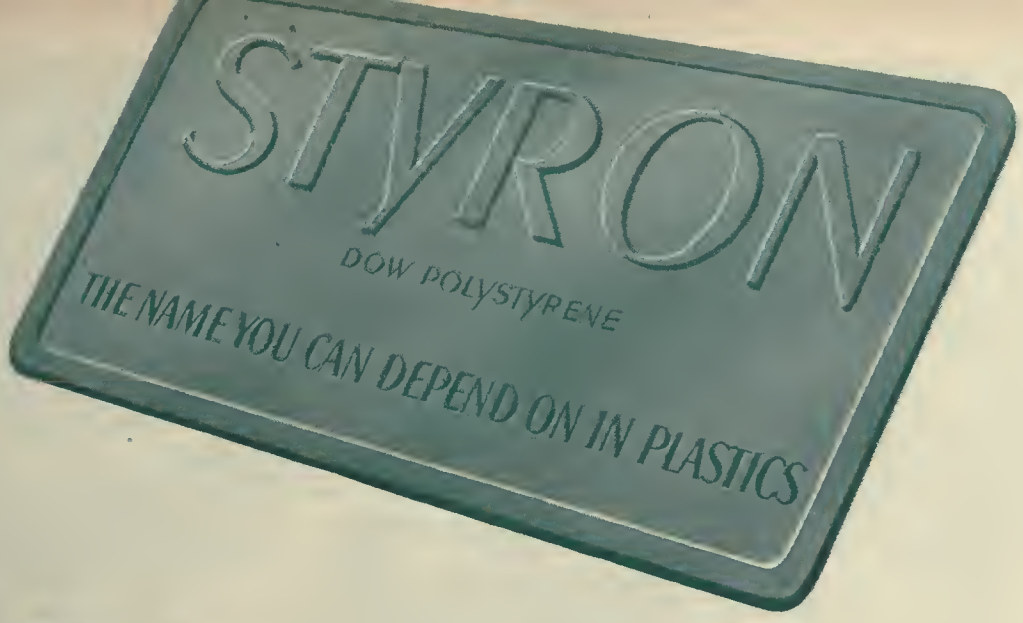
50,000 bugles will be molded for the civilian market

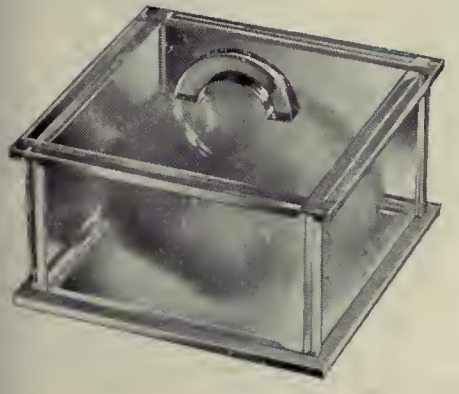
Extruded fishing rod holders are light, rigid, colorful

ONE of the most popular thermoplastics molding materials today is cellulose acetate butyrate, marketed under the trade name *Tenite II*. The development of this material resulted from experiments made by Tennessee Eastman Corporation with cellulose acetate in search of a molding composition which would impart superior dimensional stability and impact strength to the beauty and toughness of the earlier plastics. With the advent of *Tenite II*, in 1938, the already extensive use of the cellulosics was broadened still further.

The butyrate possesses hornlike toughness and exceptional impact strength and resiliency, with lightness of weight, good dimensional stability, low moisture absorption, high luster, high dielectric strength, and low heat conductivity. It is made in as many as 17,000 colors, ranging from transparent through translucent to opaque, and including metallic, pearlescent, variegated, and fluorescent effects—all colors being an integral part of the material so that they cannot chip or peel. These characteristics, plus the fact that *Tenite II* is made in a number of different formulas and flows, which permits the stressing of a particular property according to the intended use, adapt it to an almost limitless variety of molded and extruded articles.

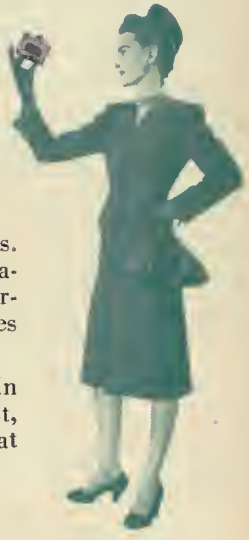
Among the widely divergent uses are fishnet floats, durable and weather-resistant, which are being used in increasing quantities by U. S. salmon fishers. These floats are preferred because they retain their buoyancy, withstand rough treatment, and never have to be refinished. Their color remains as permanent identification of the various





leads the way

n cosmetic containers



y products demand more brilliance in packaging
n cosmetics. Yet in this highly competitive field
ron, a Dow plastic, stands out.

ends glamour at the point of sale. Its hard and
nished surface stops roving eyes in any array of
ducts. Styron imparts new magnetism to goods.
l it draws more buyers because of its possibilities
later use as a decorative container. In this field,
ron's qualities add up to greater sales.

Styron easily passes these tough tests—and others. For this Dow leader in plastics has myriad applications—from costume jewelry to batteries, refrigerators and automobiles. It provides stepped-up sales appeal, but wide serviceability, too.

Styron's properties* suggest broad usefulness in many products. For improved products at low cost, more and more manufacturers are realizing that Styron is the name you can *depend* on in plastics.

cess in plastics is measured only in end products. It calls for combined efforts
anufacturers, designers, fabricators, raw material producers. Dow is ready to
ts part. Save time and money—call on Dow and *get the most out of plastics.*

SENT AND POTENTIAL USES—Lighting fixtures and displays; insulators; hydrome-
; battery cases; funnels; bottles; closures; food handling equipment; pharma-
tical, cosmetic, and jewelry containers; jewelry; advertising items; refrigerator
s; pens, pencils; chemical apparatus; lenses; decorative objects and trim.

OPERTIES AND ADVANTAGES—Beautiful, clear, translucent; "pipes" light through
around corners, etc.; resistant to acids and many alkalies; stable at low
peratures; excellent electrical properties; broad color range; low specific
ity, providing more moldings per pound; low water absorption.

DOW
PLASTICS
STYRON • STYRALOY • ETHOCEL
ETHOCEL SHEETING • SARAN • SARAN FILM

Need for tough, shatterproof housing for electric drill is adequately met by lightweight "Tenite II"

fishermen's nets and makes for easy visibility in the water.

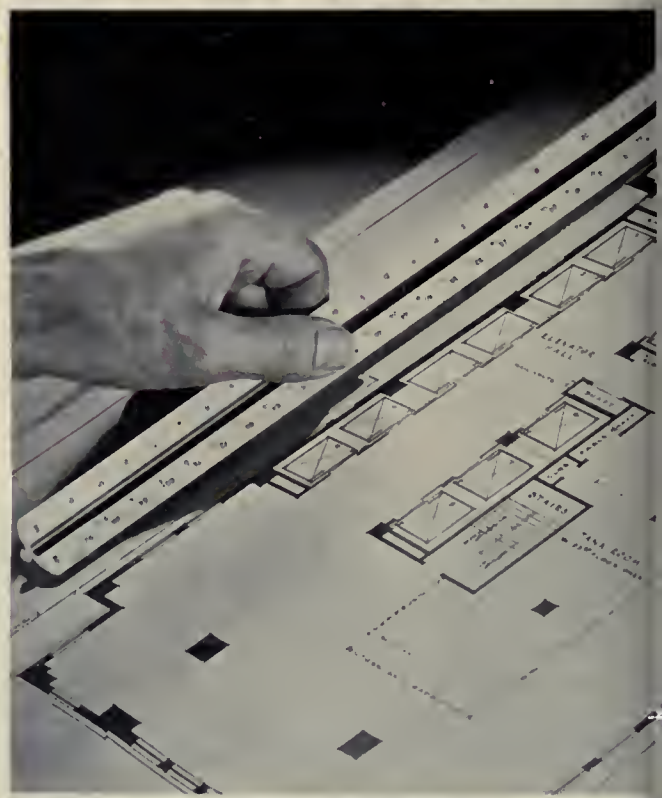
Extruded butyrate tubes are used to siphon water from irrigation ditches into the fields of Western farmlands. Extremely light in weight, they are easy to carry and install, require little maintenance. Possible obstructions are readily located through the transparent material. Made of a special formula of cellulose acetate butyrate which incorporates an ultraviolet-ray inhibitor, the tubes resist the effects of blistering heat and sun and perform efficiently under continuous exposure.

Radiotelephone handsets of *Tenite II* have recently been applied to fill an important need in the railroad business. By making possible two-way communication between locomotive and caboose, between train and wayside office, and between trains, they greatly increase the safety and efficient handling of railroad traffic. The material was chosen because of its high impact strength and its ability to withstand the rigorous use which these phones must undergo.

Tubular sleeves are molded of *Tenite II* to be driven onto the handles of standard pliers as insulation against electrical shock. Tough and resilient, the sleeves are forced on by hammer blows without cracking or splitting them. In place, they conform tightly to the shape of the plier handle. Diamond knurling on the surface provides a non-slipping grip for leather gloves or bare hands in cold weather, and the plastics is always pleasantly warm to the touch. Bright red coloring makes it easy to find the pliers if they are dropped in grass, dirt, or snow.

Bayonet scabbards made of extruded plastics molded over

(*Continued on page* 37)



Triangular scales retain form when made of "Tenite II"

RED vs. RED

- Red . . . the angry color of destructive fire!
- Red . . . eye-arresting color of the nation's watch-dog against fire—*the A. D. T. Aero Automatic Fire Detecting and Alarm System!*
- The cover of this control box is Plaskon Molded Color . . a brilliant, permanent vermilion that shouts "Here I am!" when fire must be fought.
- One important feature of Plaskon plastics is the wide range of never-fading colors available. Rich, handsome colors that can be used efficiently for both their practical and beautifying value. In gay, brilliant hues or restrained tones, ranging from jet black to neutral white, Plaskon can be molded economically to harmonize with the character of a wide range of products.
- Molded Plaskon is strong and non-shattering. It has a smooth warm surface, is unaffected by oils, fats or common organic solvents; and is highly resistant to arcing or tracking under high voltages and high frequencies.
- We can give you helpful assistance in suggesting designs, qualified Plaskon molders, and technical advice so that you can efficiently adapt Plaskon Molded Color to your manufacturing and sales programs.

PLASKON DIVISION • LIBBEY • OWENS • FORD GLASS COMPANY
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In Canada: Canadian Industries, Ltd., Montreal

PLASKON

TRADE MARK REGISTERED

MOLDED COLOR

DRAINAGE TESTS *prove*

Tri-Sure Closures Give 8.34 Ounces More Per Drum

Photograph of T-square placed across the closure fitted in the drum clearly shows the flush fitting of the flange which allows complete drainage.

ONE of the major oil companies recently made exhaustive tests to determine the efficiency of drum closures from the standpoint of drainage.

Tri-Sure and other types of closures were tested in 55 gallon drums under identical conditions. After draining the contents (Lube Oil) from the drums only 3.38 fluid ounces remained in those fitted with Tri-Sure Closures, the average contents remaining in all other drums being 11.72 fluid ozs.

Benefit to users of Tri-Sure fitted drums — 8.34 fluid ounces — the equivalent of more than 600 gallons in every 10,000 drum shipment.

In addition, drums sealed with Tri-Sure Closures assure protection from leakage, seepage, tampering, substitution and breathing.

Tri-Sure
Reg. U. S. Pat. Off.
CLOSURES

AMERICAN FLANGE & MANUFACTURING CO. INC., 30 ROCKEFELLER PLAZA, NEW YORK 20, N. Y.
TRI-SURE PRODUCTS LIMITED, ST. CATHARINES, ONTARIO, CANADA

(*Continued from page* 34)

fabric were employed by U. S. troops. *Tenite II*, the only molding material used for this purpose, was a natural choice because of its durability under rough usage.

Architects' and engineers' triangular and flat scales molded of the same material are found to retain accurate measurements better than the conventional boxwood—striking proof of its dimensional stability.

Butyrate is made from cellulose derived from cotton linters or wood pulp. The cellulose acetate butyrate ester used as the base of the plastics results from combining cellulose with acetic and butyric acids and anhydrides, the amount of each ingredient depending on the formula. To produce the molding composition, plasticizers, pigments, and dyes are added.

In the accompanying table are presented average figures of the physical properties of cellulose acetate and cellulose acetate butyrate, the compositions most frequently compared, though chemically quite different.

Comparative Physical Properties*

Property	Cellulose Acetate	Cellulose Acetate Butyrate
Flow temperature (°C +5)	150	142
Specific gravity, max. at 25° C	1.33	1.21
Tensile strength, min. (psi)		
25° C	4,240	3,270
71° C	1,967	1,650
Heat distortion, min., 264 psi fiber stress (°C)	55	49
Impact strength, Izod, min. per in. of molded notch (ft-lb)		
25° C	1.4	1.7
—40° C	0.4	0.6
Water absorption, max., 24 hr immersion (%)		
weight gain + soluble matter loss	4.1	2.1
soluble matter loss	0.7	0.5
Weight loss on heating, max., 72 hr, 82° C (%)	4.9	2.6
Dielectric strength, min., short-time test (vpm)	250	250

*Comparison of overage critical or important (max. or min. limits) values for molded test specimens by requirements listed under ASTM D 706-44T.

From the table, it will be noted that of the factors controlling dimensional stability under varying conditions of temperature and humidity—weight gained on immersion in water, soluble-matter loss, and weight loss on heating—a comparison favors cellulose acetate butyrate. The latter is also shown to have an impact strength 20% better than cellulose acetate at room temperature and 50% better at —40° F.

Less Plasticizer Used

Superiority in these two aspects is occasioned by the use of a smaller percentage of plasticizer in cellulose acetate butyrate molding compositions. In addition, the plasticizers used with cellulose acetate butyrate are more compatible than those ordinarily used with cellulose acetate. Thus, cellulose acetate butyrate contains less soluble matter, has greater retentivity of plasticizer, and, therefore, more uniformity of texture, greater impact strength, and better dimensional stability.

Dimensional stability, low cost per unit of bulk, rapid and uniform flow under heat, lustrous surfaces produced in molds or dies (thereby eliminating costly finishing operations), and the fact that no process in the manufacture of the plastics or the products made from it requires waiting for aging or curing—all make for quick, economical conversion of *Tenite II* into molded or extruded articles. Molded and extruded parts may be held to very close tolerances, assuring perfect fit upon assembly. The tough plastics easily withstands machining operations such as riveting, sawing, drilling, and crimping, and may be joined by solvent cement in a bond as permanent as the material itself.

The ease and speed of injection molding the material have helped make possible the production of large and intricately-shaped articles. Illustrations of such injection molded articles are telephone handsets, portable-radio housings,

(*Continued on page* 94)

Strong, light radiotelephone handset for railroad use

Siphoning eliminates digging down and re-building bank

Printing title on case widens scope for cover design

Old Titles in New Jackets

By M. L. Stephen

Acetate slipcases, first adopted for set of children's classics, promise to supersede paperboard cases on all quality-made books

A NEW avenue of production for both rigid sheeting manufacturers and plastics container fabricators has been opened by Grosset & Dunlap, one of the largest book publishers, who are using a slipcase of transparent cellulose acetate sheeting for a series of beautiful books for children. The new plastics slipcase is a brilliant improvement on the familiar paperboard case which one has become accustomed to seeing on books of quality manufacture. While a few attempts at plastics slipcasing were made before the war, on one or two technical books, the Grosset & Dunlap project marks the first instance of its use on books for the public and the first time it has been applied to the mass production of books.

The potentialities of this departure in book publishing can be gauged from the reaction of Margaret Byrnes, head of the book department of R. H. Macy & Co., in New York. It must be remembered that the Macy book department, like the store itself, has long been in the nature of both an institution and a merchandising bellwether. "Aside from the fact," Miss Byrnes said on the day when the acetate-slipcased books were first put on sale, "that these are some of the most beautiful editions of children's classics that I've ever seen, I'm particularly interested, as a bookseller, in the acetate slipcases on the deluxe editions. This use of acetate, over the full-color bindings, lends itself to some wonderful store displays and, in addition, furnishes good tough protection to the books that are on the counters. Our customers are as enthusiastic about these books as we are and the proof is that the editions are selling like the proverbial hot cakes."

From the standpoint of the bookbuying public, the new cellulose acetate slipcase offers several attractions. Aside from protecting the book against dust, it is also beautiful in itself and pleasant to handle, and it allows the brilliant

(*Continued on page* 107)

Illustrated Junior Library, with its novel case, gets featured display in children's book section of Macy's

YOU WIN WHEN OUR "PAPEROLOGISTS" PUT "*Mosinee*" TO WORK FOR YOU!

MOSINEE, as a product material, continues to meet many product-engineering and production requirements, where improved quality and greater utility must be linked with lower costs, to win new markets or expand present fields.

To "make the most of paper", engineered as part of your product . . . or your packaging...it pays to put Mosinee "paperologists" to work. With broad experience, extensive laboratory facilities and efficient production methods at their command, they can establish controls that assure definite dielectric strength, uniform density, specified maximum-minimum pH, moisture repellency, high tensile strength, and other technical characteristics which help make products winners!

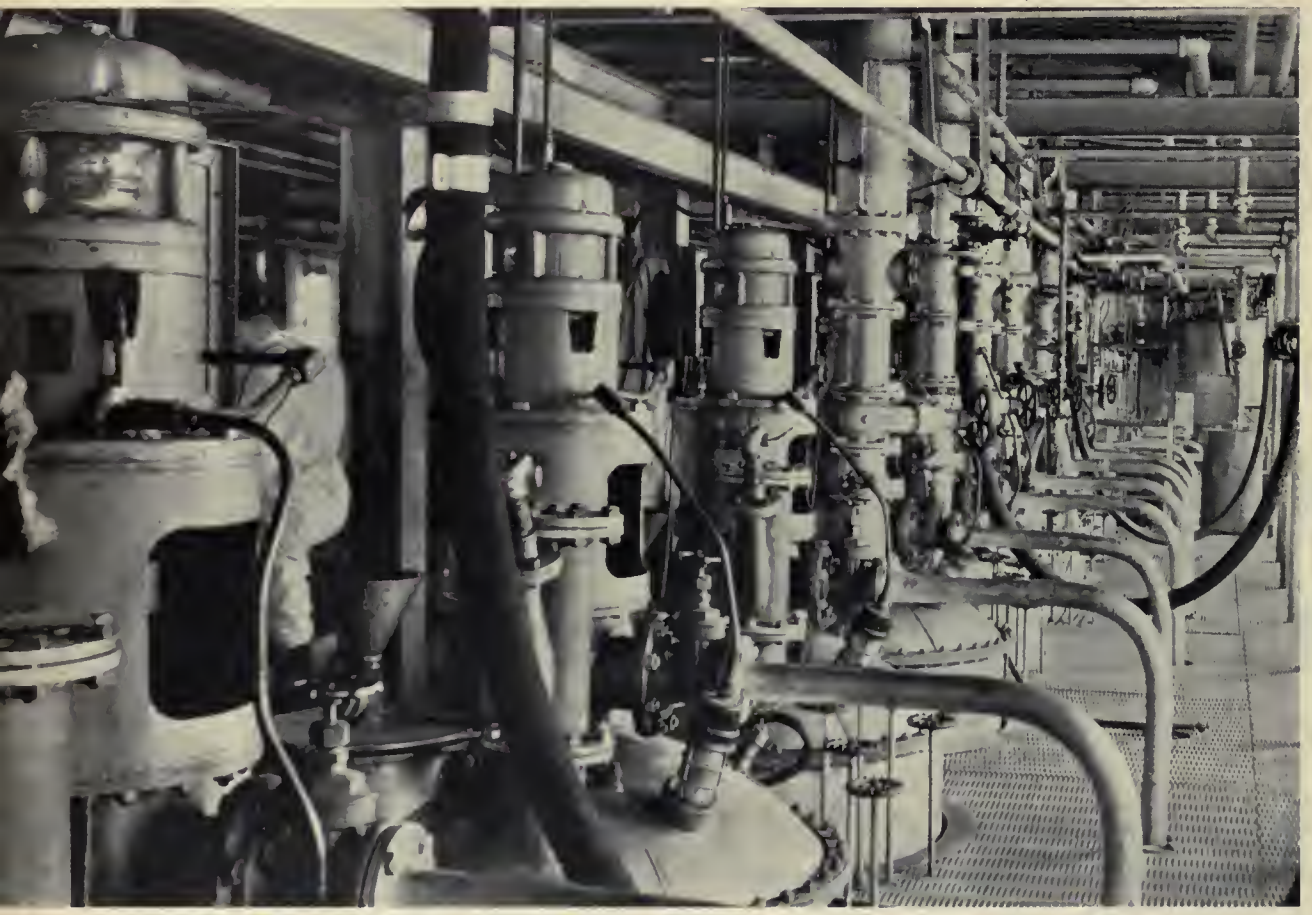
A conference between the "paperologists" of The Mills of Mosinee and your management, product engineers, production and sales executives, should prove constructive. MOSINEE is ready.

MOSINEE PAPER MILLS COMPANY
MOSINEE • WISCONSIN
Essential Paper Makers

Please address your letter "Attention Dept. E"

Where are the Materials?

Manufacturers present their views about materials shortages, causes of the situation, and prospects for increased supply



Processing kettles in a Catalin plant are continuously working at capacity to meet materials demand

By William Schack
plastics Field Editor

THERE are a number of problems agitating the users of plastics in this transition period from war to peace, but no one question is put more frequently than this: "Where are the materials?" Inquiries keep coming into our own office for every type of plastics—one man wanted 50,000 lb of urea formaldehyde a month for six months, beginning at once!—and the materials manufacturers are deluged with letters, personal and telephone calls, and telegrams, requesting plastics in quantities which cannot be supplied. Not only are new end users puzzled by the shortages—even those who were well-established before the war cannot understand why their requirements cannot be met.

Everybody knows that the plastics industry expanded tremendously during the war, and assumed that once military demand had stopped or at least had been greatly curtailed, the market would be flooded with plastics materials. People say, "We read all about the huge production of styrene for the manufacture of synthetic rubber. Now that production of that elastomer has slackened, why can't we get all the polystyrene we want?" They know that other plastics—ethyl cellulose, for example—also came into their own for war-time applications, and they cannot imagine why they are not now available in indefinite supply. The situation is so tense that they tend to think of it in dramatic terms: some of them think of the materials people as the villains of the play. The notion is of course absurd, for the materials suppliers are in the business of selling, and they would be only too glad to ship everyone as much as he wants, if they were able to.

Nevertheless, to try to clarify the situation, we have put the burden of the complaints up to the materials producers and asked them for their answers to the question everybody is asking. In a very few cases we were not able to elicit any information. We do not think this was due to any ill will or lack of desire to cooperate on the part of these particular manufacturers. We rather think their reticence was due to embarrassment at finding themselves in the position they are, and to their decision not to make premature promises of an improvement in their position. From the replies we did receive, however, one can form a definite picture of the condition of the industry as a whole.

It is natural to suppose that a considerable amount of plastics materials might have been tied up in war-time formulations which were not suitable for civilian uses. But on this score the manufacturers are unanimous—that is not

SYMBOL OF SKILL AND ABILITY IN THE PLASTICS INDUSTRY

THE [illegible] MICHIGAN

MOLDED PLASTICS, INC. An intimate [illegible] customers . . . a personalized service that focuses complete attention on *every* order . . . these, linked to the astounding range of versatility that has produced miracles in plastics . . . make *Michigan Molded* a name synonymous with *plastic-excellence.* Small but mighty is Michigan Molded: the very modesty of its size and over a quarter century of experience are contributing factors in those intimate details producing real satisfaction . . . real and lasting results! We're busy now, but never too busy to consider your plastic needs . . . Sales and Engineering Offices are located in: Buffalo · Chicago · Cleveland · Dayton · Detroit · Kansas City Minneapolis · Moline · Philadelphia · St. Louis. General Offices and Plants: Dexter, Michigan.

Materials output has not kept pace with new-press supply

the case to any significant degree. According to the Dow Chemical Company, "with few exceptions, our military materials will simply switch over to civilian applications." Similarly, the Plastics Division of the Monsanto Chemical Company declares that "some war-born formulations will continue to be produced for civilian use." More specifically, the Chemaco Corporation states: "It is our firm belief that the cellulose acetate and ethyl cellulose formulated for military end uses will find a wide adaptability in civilian applications." The Hercules Powder Company concurs in this, affirming that "the end use applications for cellulose acetate were greatly expanded during the war through improvement in the properties of the flake, formulations, and compounds. The types of acetate necessary for war, having been greatly improved, could all be used in the expanded markets for peace-time applications, so the demand has continued to be increasingly higher."

So far as thermoplastics generally are concerned, special formulations were made up on very short order, in as little as 24 hr, according to one authority, so that there was no possibility of a surplus being left over which could not fit peace-time outlets.

With this factor ruled out as a possible cause of present shortages, we turn now to the actual causes on which the materials manufacturers are quite agreed. First and foremost, production facilities are inadequate in many cases. Thus, Hercules, which makes the uncompounded cellulose plastics, had, even during the war, scheduled a 250% increase in its production facilities of ethyl cellulose, but has realized only a fifth of this expansion to date. While the annual demand for cellulose acetate is estimated at 250,000,000 lb, current capacity is reliably put at just about half that figure. In the case of the ureas, a special situation existed at the Bakelite Corporation, in that the company had converted its production facilities for this material to the manufacture of the phenolic-lead compound used in the making of the frangible bullet, and it will take time to change back to full urea production.

Growth of laminating adds to demand for more materials

The strain on existing production facilities arises from the fact that the market for plastics materials has been widely extended. As the uses of plastics have increased more and more processors have entered the industry, and this in turn has been made possible by an increase in molding and fabricating capacity. One injection machine manufacturer is, in fact, reported to be planning an output of some 350 to 500 machines in the next nine months. As Chemaco points out, "This increase in the production of machines to consume plastics materials has not been matched by an increase in the production of the materials manufacturers." In fact, other sources estimate that the number of orders for such machines placed with all manufacturers for delivery in the next 18 months, is equal to the entire number of machines now in operation.

In discussing the materials situation, Tennessee Eastman reports a record demand for *Tenite I* and *II* far exceeding the supply and that, as a temporary measure, materials have had to be allotted on a monthly basis, and then adds: "The situation may be attributed to the long-felt need for civilian goods and the greatly expanded production facilities of the molding industry which was brought about by the war."

To add to the difficulty, even present capacity is not being fully utilized in several important companies. American Cyanamid, for example, reports a serious labor shortage to account for it. Women are quitting the plants in which they worked during the war, usually to rejoin their husbands returning from overseas; while men are looking around for better jobs, and many of those who have been let out of high-paying war jobs are not enthusiastic about a new job which has a lower starting wage. Marblette Corporation is also not operating at capacity because of a lack of experienced labor, and estimates that it will require several months to get into full swing. Shortage of labor had its effect on nitrate production several months before the war ended, according to Hercules, and this condition still exists, at a time when the demand "continues to be the highest in years." Bakelite's flow of thermosetting compounds is retarded for the same reason, though it is said to be maintaining its volume of vinyl production.

Still another difficulty is that there is sometimes a shortage of materials processing equipment even where there is ample raw material supply. Reference was made before to the abundance of styrene and the shortage of polystyrene. The trouble here is that you can't make plastics out of styrene before you polymerize it, and there is a lack of equipment to do this essential job.

These, then, are the basic factors in the situation. The all-important question remains as to when and how rapidly it will improve. The answers we have obtained are reassuring in varying degree. They are given here realistically and without trying to make the picture more rosy than it is, on the ground that the users of plastics can make practical plans for adapting themselves to the realities whereas, otherwise, they would only flounder in a pretty dream. The Dow Company reports that it is expanding its production considerably, especially of *Saran* and polystyrene, estimating that it will take some months for production to catch up with demand, with eight to ten months set as the period in which the problem can be largely met. It was Dow's policy to concentrate on its war efforts and "to do its post-war planning post-war." The bottleneck, so far as this company is concerned, is plant construction, for which materials are only now becoming available.

We have mentioned the plan of Hercules with respect to

DURITE

PHENOLIC PLASTICS

Courtesy, National Union Radio Corp.

BASING CEMENTS

MOLDING COMPOUNDS • INDUSTRIAL RESINS

DURITE PLASTICS INCORPORATED • 5000 Summerdale Ave. • Philadelphia 24, Pa.

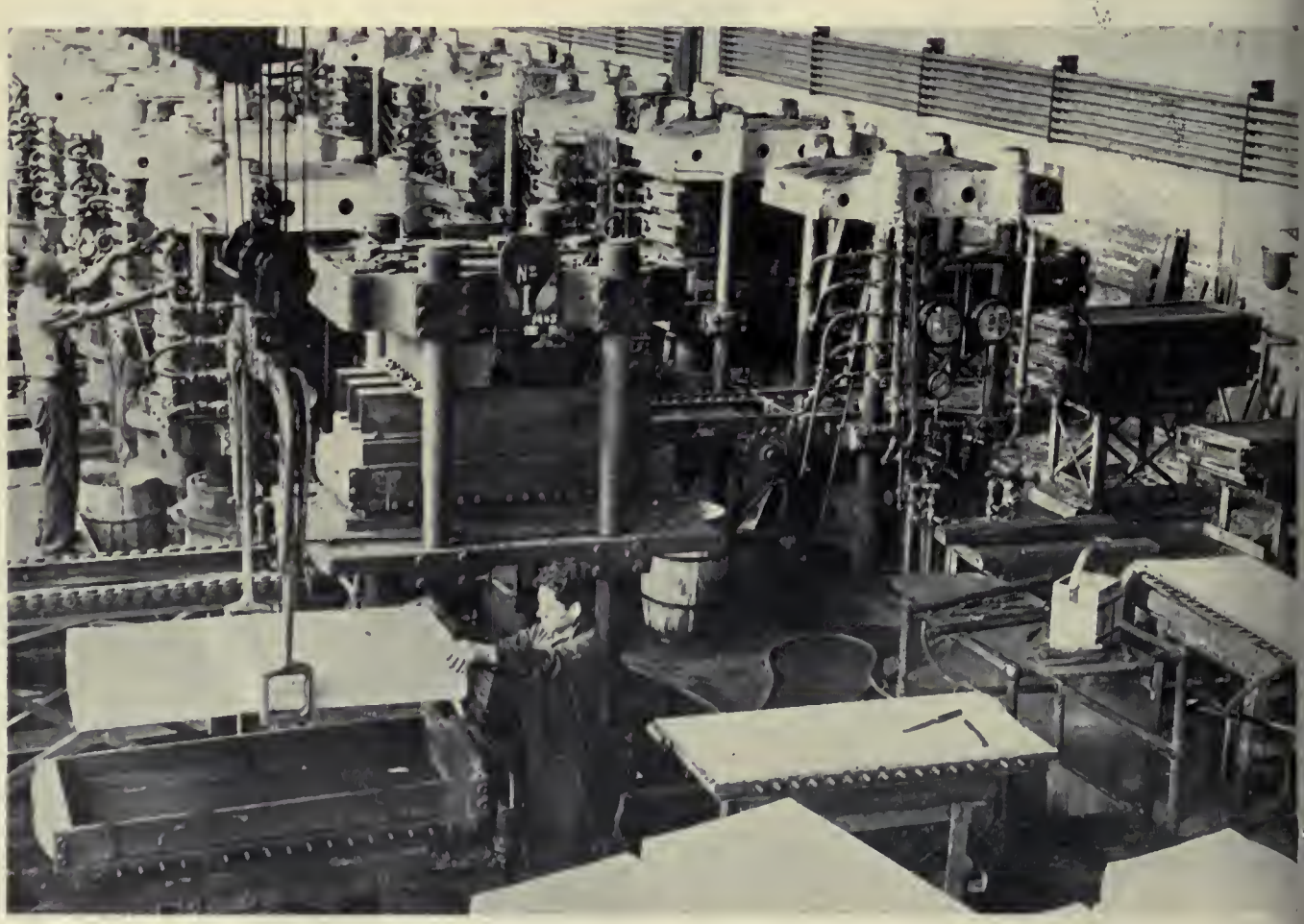
expanding its facilities for the production of ethyl cellulose. This firm is reportedly operating at capacity, but is also expanding its plant for cellulose acetate production "as fast as possible," with more nitrates available by now. Catalin Corporation, trying to supply a big backlog of orders as well as new business with "overcapacity" production, also reports being engaged on a "modest enlarging" of plant, including the installation of more curing ovens. Durite Plastics, producers of phenolic and furfural molding compounds, likewise reports an increase in production under way. Tennessee Eastman is enlarging its manufacturing plant, but believes that "the effect of its increased production will not afford relief until the forepart of 1946." Rohm & Haas reports standard *Plexiglas* sheets available for immediate delivery, space open for prompt production of special thicknesses and colors, but that molding powders are temporarily short, with additional capacity ready early in 1946.

Taking a long-time view of the situation, Monsanto looks to a substantial increase in plastics production facilities during the next five years, and points out that "because of increased molding and fabricating capacity, broadened markets and, in some cases, lower prices, it is difficult to prophesy when supplies will be abundant."

Meanwhile, in this trying in-between period, there is going to be a struggle between the new and old users of plastics for the available supply. Manufacturers are not laying down a hard and fast policy for the division of the "spoils," but it is safe to say that they will give substantial customers of the past a good break, without neglecting the potential new market. Those who have a likely new commodity will find the suppliers regarding them with a friendly eye, and those newcomers who show a capacity for doing a volume business in the future, even with conventional products, will not find themselves crowded out by even the best of the old-line customers. One big company did say that, in general, it would favor the makers of well-tried products as against those who were making what seemed temporary use of a certain plastics because another and more appropriate one was not available. For example, at the present time there is a very large demand for ureas for white poker chips because the preferred phenolics are not to be had. Such customers, this manufacturer feels, would swamp the market with white poker chips and then have no use for ureas for an indefinite period. That is not the kind of trade the supplier wants.

It is not likely that any user of plastics will be cut off from materials altogether, but there is every likelihood that most users will not be entirely satisfied at least for a few months to come. END

Plans for raising output often include new construction like this Libbey-Owens-Ford Plaskon Research Laboratory



Available processing equipment is frequently not fully utilized because of serious labor shortages

We too whistle while we work
If quality is what you wish, we'll build that in for that's our dish!
We'll put in lots of good design So folks will say that's really fine
Don't matter if it's large or small, we'd like your job so, why not call!

. . . *We Are Not Molders*

. . . *We Don't Extrude*

QUALITY FABRICATION IS OUR BUSINESS

We welcome your inquiries regarding any type of precision fabrication . . . display fixtures . . . furniture . . . the fabrication of cast phenolics . . . radio cabinets . . . jewelry . . . any type of production that comes within the scope of modern plastics. Our policy is: No job is too large or too small . . . quality materials and workmanship an integral part of every assignment.

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Plastics Division

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Plastics at Work

Maintenance of flexibility at low temperatures is an aid to quick and easy release of ice cubes from these individual cube containers made of white, satin-smooth Dow "Ethocel"

Urea formaldehyde, black for the barrel and red for top, with black polystyrene push button at bottom, form this "Lektrolite" flameless lighter

Utilitarian items such as electric alarm clocks blend with modern decorative schemes, as in this G-E model of ivory-toned urea formaldehyde, with hour and minute hands of brown, and gilt second hand

A miniature palette-shaped display fixture of clear acrylic supplies an ideal background for showing merchandise items such as handkerchiefs, hosiery, or other dainty accessories

Ingeniously simple in design, a "safe-light" for use in photographic dark rooms employs translucent red plastics in the two-part, quickly-adjusted covering for light bulb

"Dzus" cushion-type spiral cam fastener gives correct tension, thus preventing breakage of plastics. Application on plastics film winding case differs from fastener at left only in possessing a knob-type instead of a screw-type head

Engineering for Spring-Tension Fasteners

New and improved devices widen field of use for plastics both alone and with other materials

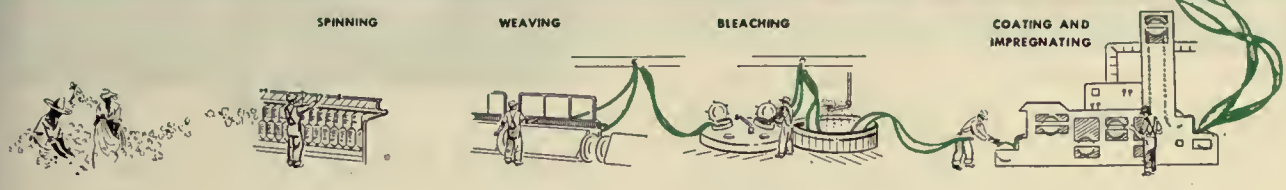
THE resilient cushion, or spring tension, steel fastener, used to a large extent in such industries as aviation, refrigeration, and radio, has been modified over a period of years to meet specifications in the plastics industry. It can now be successfully used to hold two or more plastics parts firmly together without scratching them. Some typical applications, with many more in process of development, are for fastening parts with integrally molded plastics studs, holding plastics knobs to shafts with "D" shaped ends, assembling plastics fish lures, and fastening plastics trim strips.

The basic purposes of the spring-tension fastener, made of light spring steel properly heat treated, are to effect a more secure connection in holding two or more plastics parts together and at the same time reduce weight and space without damage to the materials.

One of the first full lines of spring-tension fasteners for plastics parts was developed by Tinnerman Products, Inc., Cleveland, about ten years ago. Since that time the line has expanded considerably with new shapes and sizes to meet new conditions. In recent years other manufacturers have also come into the field. Among them are the Boots Aircraft Nut Corp., the Simmons Fastener Corporation, the B. F. Goodrich Co., and the Dzus Fastener Co.

The Tinnerman Company produces a line for all types of materials as well as for plastics, including Speed Nuts and Speed Clips specially designed for integrally molded plastics studs; Speed Clips for holding electric wiring; Compression Spring Clips for holding plastics knobs to various types of shafts; special clips for split hubs; and twin Speed Nuts for assembling plastics fish lures, flash lights, pilot

Boots Self-Locking Cage Nut (1) is clinched firmly by tool (2) into plywood (3) so that it will not turn in hole



These are but a few of the items for which our plastic coated fabrics and papers will be used after the war.

There are many other applications, of course, some of which are already familiar to our research staff—many more have not yet come to our attention.

Check *your* post war plans. Do plastic coated fabrics and papers show up anywhere in the picture?

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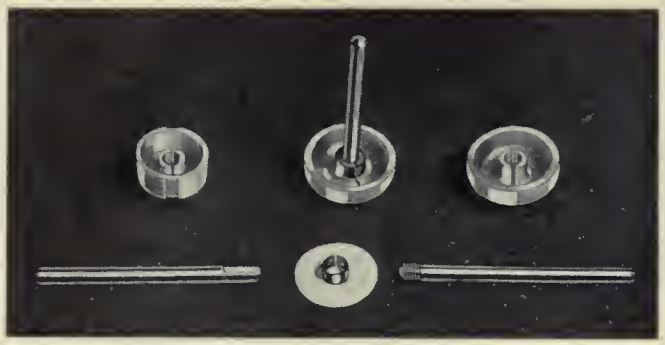
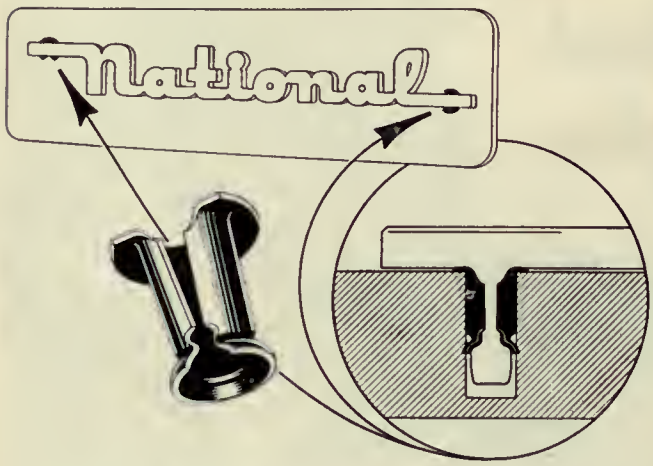


Tinnerman compression spring clips may be used on split or "D" shaped hubs, with threaded or "D" shaped shafts



Nameplate studs, held by tension, in turn exert tension on tubular clips making them lock firmly into plastics

lights on cooking ranges, temperature controls on refrigerators, nameplates, escutcheons, radio bezels, plastics trim strips, and scores of other parts.

One of the most satisfactory time and money savers in all types of plastics assemblies is the "push-on" Speed Nut. This spring steel nut can be pushed instantly over the integrally formed plastics stud as it emerges through the part to be connected and bites so firmly into the plastics that there can be no loosening from vibration. For high speed applications, special tools are used, but in the majority of applications they are merely pushed on with thumb and index finger. Once applied over a plastics stud, tube, rib or other form, they grip with a secure lock held under constant spring tension.

These fasteners embody some unusual features. One is a wide bearing surface which spreads the load over a greater area. This makes the nut widely applicable to all types of plastics materials regardless of their hardness or thickness. Another important patented feature is the self-energizing spring lock. In this lock the compression of the arch in the prongs as well as the base of the nut makes it self-energizing; that is, when direct pressure is used to separate the assembly, the prongs bite deeper and the nut holds more securely.

The Goodrich Rivnuts for plastics assemblies are standardized on the 100° countersunk flathead .063". They are made in aluminum, brass, and steel. A hole in the material to be riveted is formed with the drill slightly deeper than the length of the Rivnut. The hole is then countersunk 100°. Then the Rivnut is set in place with the splines in a position to engage the plastics or surrounding material.

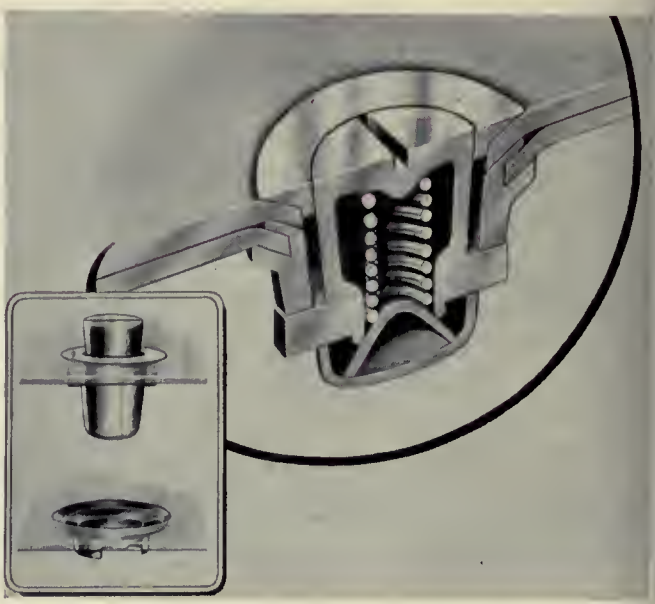
The Dzus fastener was developed primarily as a cowl fastener for airplanes but is now finding other uses. It is quickly applied, and is self-locking, although not light in weight. For those applications in which the fastener is not required to take as little room as possible, the Dzus fastener has many useful applications in spite of its moving parts and protrusions.

The Boots Cage Nut used for plastics and plywood assemblies incorporates a wing type self-locking principle and is used primarily in blind installations. The basket mount of this nut is collapsed with a clinching tool, which clinches the plastics in a claw-like grip, so that it will withstand the torque applied when a bolt is inserted.

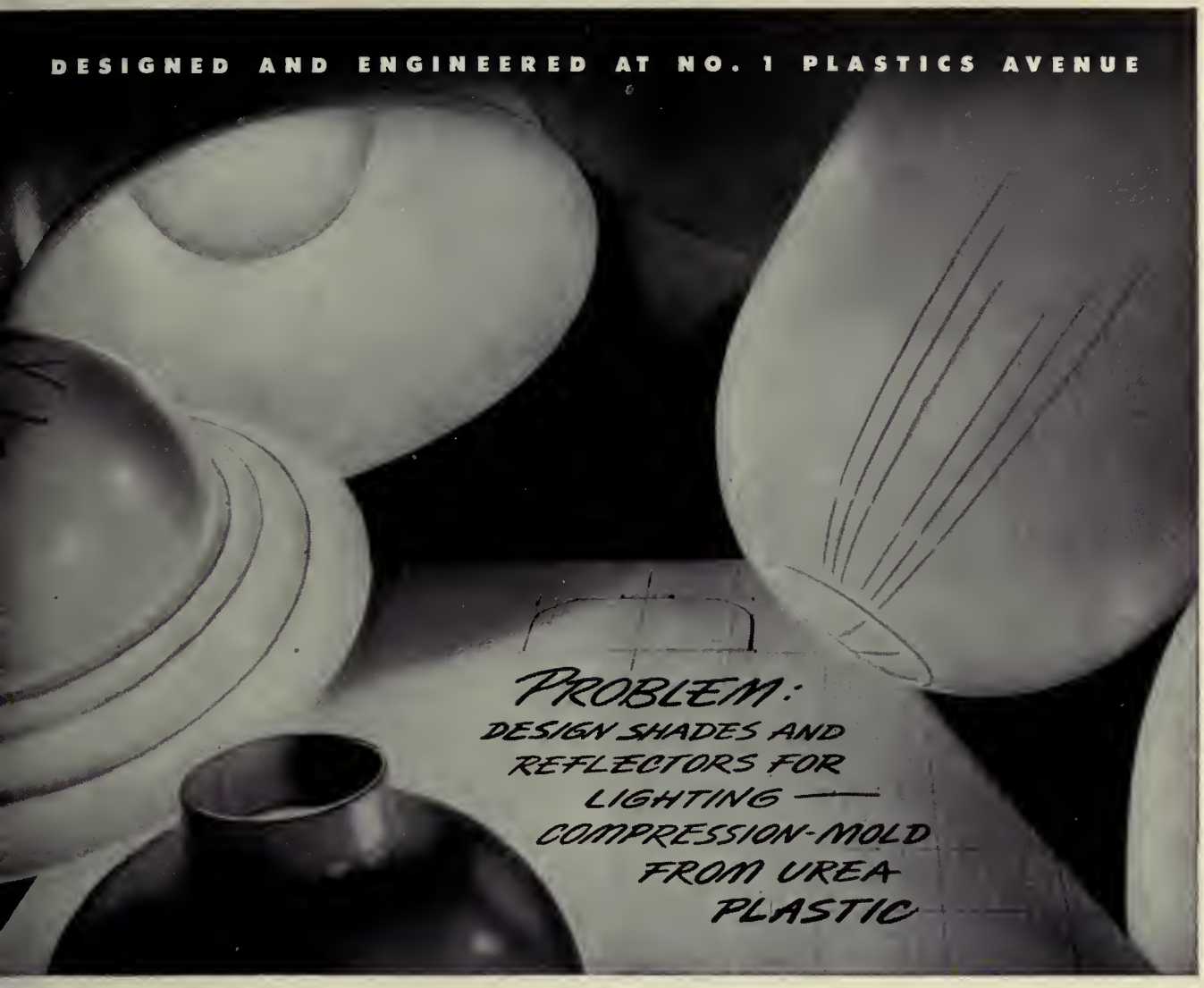
The Simmons fastener employs the spiral principle with a cam fastener that develops a spring-tension grip by means of a round, wire-like arm that locks with a 90° turn.

(*Continued on page* 95)

The Simmons "Spring-Lock" fastener is inserted, then is turned 90° to lock round, wire-like arm in tension grip



In Simmons "Quick-Lock" type, stud is depressed against spring action, quarter-turned to lock under cam surfaces



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Rohm & Haas molds bars and discs as test specimens in its own experimental shop

MOLDING ACRYLICS

Molding offers advantages over fabrication where numerous small identical parts are to be made

AS THE plastics industry continues to build up its supply of knowledge on plastics and on means to convert them into finished goods, fabrication techniques are developed to supplement molding for particular articles, and vice versa. Such is the case with the acrylics where, in the manufacture of large quantities of identical parts, compression and injection molding often offers many advantages over fabrication. Within certain limitations of size and shape, molding is faster, usually cheaper, and often permits closer dimensional control than fabrication.

Intelligent molding serves to simplify or eliminate finishing and assembly operations. Though these savings may occasionally not be enough to offset the cost of the mold, usually they more than justify it, plus any higher materials cost that may be involved.

A section in a new *Plexiglas Design Manual* published by Rohm & Haas summarizes experience to date with the molding of methyl methacrylate and is designed to further efficient and satisfactory results in the molding of this material. A series of *do's* and *don't's* presents the molder or would-be molder of acrylics with a concise set of instructions. These follow much as they appear in the *Manual:*

Keep cross-section as uniform as possible. Favor rounded rather than sharp corners: This recommendation applies to major dimensions and contours. If a part is to be subjected to flexural stress, a filleted corner is far less liable to crack than a sharp one. The material will flow better in a mold with rounded corners, thereby reducing the danger of sticking. Finally, it is usually cheaper to make a mold with rounded corners than with sharp corners. Sharp edges are desirable, however, for markings in dials and nameplates, to facilitate wiping-in pigment.

Mold in mounting rims or lugs to save assembly parts and time: Mounting rims or lugs should be as substantial as possible, particularly if the molding is to be subjected to impact or flexure. They should be at least half the thickness of the molding, and as long and numerous as possible

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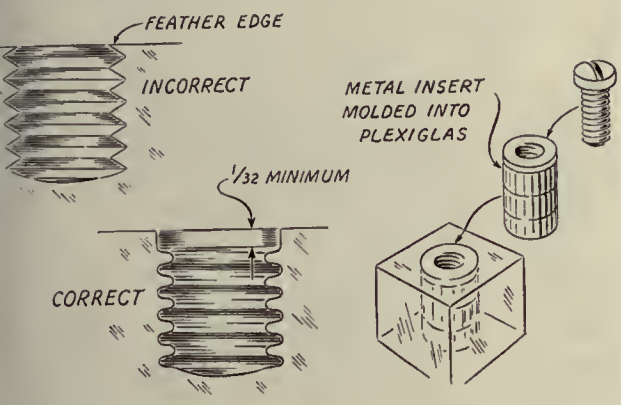
-or, prefcrably, continuous. A convenient modification is make the mounting lug a cut-out step in a chamfered lge. Lugs should be filleted into body of molding to avoid arp corners. A mounting holc may be placed in the lug, ovided that sufficient material is allowed all around it. his rim around the hole should be at least as thick as e lug itself.

Mold in screw threads to save assembly time: Alough molded-in threads incrcase mold cost, they save asembly time. Thcy should be coarse and hcavy with rounded exes to reduce danger of cracking. Threads should not e started at the surface of the molding; at least 1/32" ould bc allowed to eliminate a feather edge. Molded reads are not practicable except for hole diamcters of 4" or more. If the saving in asscmbly does not justify e increased mold cost and other costs, such as that of



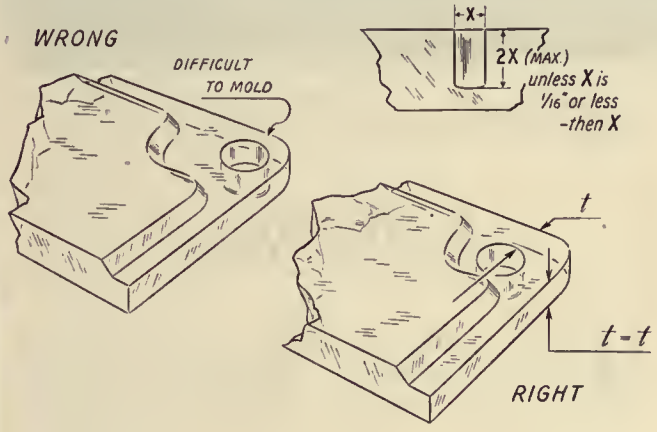
apping, threads may be tappcd in a molded part. If so, countersink should be molded in as a guide to the tapping ie. If the part is to be frequently disasscmbled, it is probbly preferable to use molded inserts in the part.

Do not place mounting holes near the edge of moldng: For grcatest strength, mounting holes should not be ess than the thickness of the molded piece and preferably

Lamp enclosures illustrate possibilities in molded acrylics

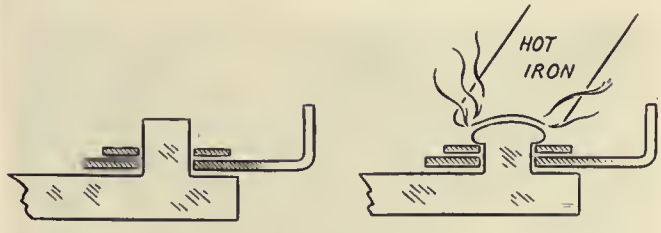
Extrusion is fast, economical for uniform cross sections

a grcater distancc away from the edge to allow for flow of material around the pin in the mold. If possible, the hole should pass entirely through the part so that core pins



can be supported in both sides of the mold. A good design rule is that the depth of the hole should not be more than twice the diameter of the hole. Small holes (1/16" or less) should not be deeper than the diameter of the hole.

Use molded "rivets" for mounting to metal: Short projecting lugs may be incorporated in the molded part



which can later be sealed over by heat and pressure. This process can be fast and almost automatic. The method cannot be used, of course, if the asscmbly is to be taken apart. With longer lugs, *Speed Nuts* may be used directly on the molded lug.

(*Continued on page* 98)

Machining

A review of machining methods

In sawing polystyrene the saw directly above and at the point of operation should be flooded with coolant

Drill operates through hole in coolant-supplying hose. In insert, rough hole, gummed drill result from dry drilling

By Mel Meyers

UNTIL now polystyrene has been used chiefly in purely utilitarian goods—mainly in the electrical and chemical fields—in which only a few of its properties have been taken advantage of. For example, its low power factor has made it ideal for high-frequency coil forms, its high dielectric strength has made it a good insulator, and its high resistance to non-oxidizing acids and alkalies has proved its value in battery cases and in chemical apparatus. These and other qualities have made polystyrene an outstanding war plastics. However, it has many other characteristics that are yet to find wide application, but they undoubtedly will as soon as the material is fully available for civilian production. It will then find its deserved place in consumer goods, as well as in industrial applications.

Partly because of the hitherto war-restricted application of polystyrene, but more because it is not as easy to machine as a number of other plastics, many manufacturers have not yet worked with it. But since it is a material to reckon with, it is worth while reviewing the methods which pioneer fabricators have developed.

There are two characteristics of polystyrene which make it more difficult to machine than some other plastics. One is its low softening point, about 180° F. The other is its consistency. The combination of both factors tends to cause the material to gum. Gumming is especially likely to take place at about 200° F at the point of, or in the area of, operation. In addition, overheating of the material, even if no gumming takes place, may produce crazing and cracking that will not show up at the moment of operation, but will make its appearance days later.

Because of these factors, the machining of polystyrene has an element of unpredictability which makes setting down hard and fast rules difficult. For example, some fabricators use coolant liberally at the point or in the area of operation; others use it only in special operations. It therefore seems to be necessary at present to adjust machining procedures to the particular type of job in hand.

Carboloy vs. Steel Tools

C. F. Galehouse, vice president of Arnold Brilhart, Ltd., notes that coolant or lubricant may be avoided in perhaps as many as 80% of machining operations if certain fundamental precautions are observed. One is the use of carboloy tools for tool bits for lathe turning and also for milling cutters and the tipping of counter-bores and drills. In fact, carboloy tools are used by this firm for practically all plastics machining operations, for which it has found tool grade 88B best. For all polystyrene operations, the tool should be extremely sharp, and fine, uniform feed must be adhered to.

While a considerable proportion of fabricators utilize carbide tools, the general tendency still is toward high-speed steel. Where high-speed steel tools are used for the machining of polystyrene, the picture changes considerably with respect to both operating speeds and coolant requirements. Two precautions, however, remain the same as for carbide tools: the tool must be very sharp, and the feed must be fine, unforced, and uniform.

Most of the machining procedures and data that follow are based on operations with high-speed steel tools and are

Polystyrene

devised by pioneer fabricators

provided largely through the cooperation of K. Steen Jensen, production manager, of Dura Plastics, Inc.

In using high-speed steel tools on polystyrene, Mr. Jensen finds the solution to the problems of gumming and of heat-produced crazing in the liberal use of coolant, in tool sharpness, in attention to operating speeds, and in careful feed. Coolant is used, in most cases, in a formula of 10 parts of water to one part of 40% sodium silicate. It might be noted that not all water-soluble oils may be applied to polystyrene, since many oils dissolve it. Two other good water-soluble coolants are *Vergo Oil 38-P* and *Solvac 100-M* special.

Circular Saw

While a hollow-ground saw is preferable, it is not necessary if all other precautions are observed. The blade thickness may be as small as .040″ for sections up to .090″, increasing up to 3/32″ for heavier work. A 1/16″ blade is a good compromise for general work. The diameter of the saw may be from 4″ to 10″. The advantage of the smaller blade is that it has a lower perimetric speed at any given spindle speed and, therefore, will have less tendency to heat itself and the work. The number of teeth per inch will, to some extent, be governed by the diameter of the saw, but more by the thickness of the work. A good compromise for the 4″ blade is from 8 to 10 teeth per inch. For blades of larger diameter and for thicker work sections, the number of teeth may go up to 15 per inch.

The only time coolant may be dispensed with in circular saw operations with the normal type of blade is when small cuts are being taken—cuts of not over 2″, as when sawing off a corner. Even then, the feed must be unforced. Except for these small cuts, the saw directly above and at the point of operation should be flooded with coolant. While an operating speed of from 1800 to 2000 rpm appears to be prevalent in the circular sawing of polystyrene, Mr. Jensen has found that he can reach 3450 without damaging the material or the tool, if an uninterrupted rill of coolant is fed to the saw.

If a circular saw operation on polystyrene is performed without the application of coolant, the heat-produced gum on both sides of the cut makes its appearance on both the upper and nether surfaces of the work. In the course of taking the cut, the gum on the under surface causes the work to climb as it emerges from the operation, with a resultant chatter and vibration which generates new heat in addition to the heat of the saw.

A helpful trick in circular sawing is to have the clearance between blade and saw table as small as possible to prevent the material from pulling into the gap.

Band Saw

As with the circular saw, cuts made with a band saw result in gumming unless coolant is supplied to the operation, with an occasional exception.

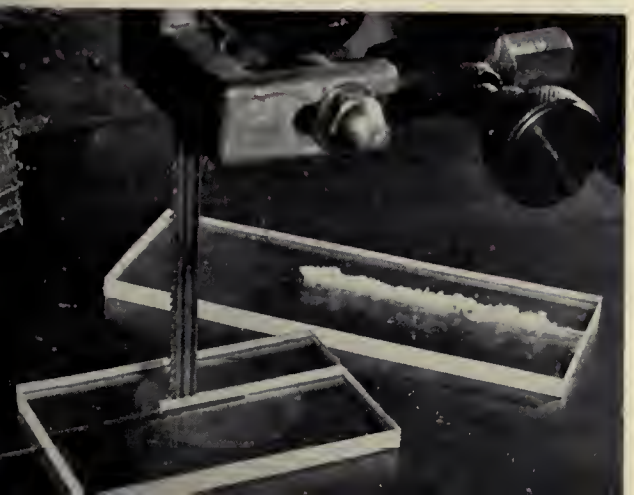
Mr. Jensen of Dura has found that the extent of lubrication needed in band saw operations can be reduced and the cutting efficiency increased by using a skip-tooth band, 4 to 6 teeth per inch, instead of the usual metal-cutting band on polystyrene sections from ⅛″ up. At ⅛″ this type of band can be used without coolant. For cuts in sections of smaller thickness than ⅛″, a metal-cutting band saw is used. Since the band for cutting thin sections must be without set in order to avoid chipping at the cut, ample coolant should be used. Band saw operating speed for polytyrene should be from 465 to 550 fpm. The band slot should be wide when thick sections are being worked, so that the waste can clear, and for sections 4″ and over, it is often advisable to remove the slot-disc altogether.

Jig Saw

As far as possible, the jig saw should be avoided in polystyrene operations. Aside from any other consideration, its chief drawback is its inability to handle the liberal quantities of coolant needed. Since the blade has a reciprocal

Here's what is likely to happen when sawing polystyrene without a coolant. Note ridges of gum. Saw clogs

Contrast between two pieces effectively demonstrates the value of liberal application of coolant over dry sawing



The facing of a large diameter polystyrene part may be a "dry" operation. Note long, straight, continuous ribbon

As result of dry sanding polystyrene piece gummed badly, but the acrylic piece displayed a smooth frosted surface

action, the coolant tends to splash up toward the operator on the upstroke of the blade. In cutting holes, it is generally preferable to rout them out instead of jig-sawing them. When the holes are to be sharp cornered, they may be jig-filed without coolant, provided the feed is light. Where there is compelling reason for using the jig-saw, standard blades may be used at a speed of about 875 cycles per minute, that is, 1750 strokes both up and down.

James Bailey, director of research for the Plax Corporation, finds that shape distortion is too great to make slicing of polystyrene feasible. However, he notes that the operation can be accomplished if both the work and the tool, as well as all metal parts in contact with the material, are kept at a temperature of 220°-230° F. Even then, some slight shape distortion will occur.

Flat sheets up to 1/16" thick, Mr. Bailey states, can be blanked if the punch and die come together all around at the same time (flat punch). A slight craze around the edge extending radially to about half the thickness of the material is usually produced in this operation. Sheets up to ¼" thick may be blanked if steam-bath heated at 212° F for 15 min before blanking.

Drilling

Drilling is another operation in which, for polystyrene, coolant must be liberally applied. As it will in drilling any plastics, coolant will provide a cleaner hole; but what is more important in connection with polystyrene, the application of coolant will keep the drill from becoming badly gummed.

For drilling polystyrene, the drill should be high-speed steel, with a lip angle of about 70° and a clearance of from 10° to 15°. A slow helix is best for most work. Cleaner holes are more easily achieved with polished flutes, although these are not absolutely necessary. A fairly sharp web is also helpful. In fact, Mr. Jensen has found that on deep holes and on holes of ⅜" diameter it is desirable to sharpen the web down practically to a point. This grinding job should, however, be done by a practiced hand if rake, clearance, and other angles are not to be thrown off.

A spindle speed of 600 rpm may be considered rather slow; nevertheless, it is a good compromise speed for drilling polystyrene. Changes from this standard speed can be avoided by accommodating the feed rate to the depth and diameter of the hole. High speeds are especially inadvisable if the device for feeding down the coolant is one in which the drill operates through a hole in the coolant-feeding hose. With this type of set-up, high drill speeds will cause the liquid to travel *up* the drill helix instead of down, pulling it away from the point of operations and scattering it at the top of the drill.

Turning

Mr. Bailey points out that operating speeds in the turning of polystyrene will be governed by a number of factors other than the type of tool and character of cut, especially by vibration. Long slender pieces should be run at a speed at which there will be no vibration. The speed in this case can be determined only by test. For light cuts, at .002" to .005" feed and .010" deep, speeds up to 1300 fpm are practicable if the piece is rigidly held. Coolant, either liquid or air-blast, is required. For inside turning or boring, comparable speeds may be used, if the diameter is large. But where the feeding of coolant to small-hole operations is a problem, surface speeds will have to be decreased. In all turning operations, the surface heat should never be raised above 190° F, which means that tools must be kept sharp and cool. If this requirement is not met, subsequent crazing of the surface is likely to occur.

Mr. Jensen of Dura has his turning tools ground to produce a straight, that is, a non-twisting, ribbon cut. The tool has a slight negative rake—about 2°, a clearance angle of from 10° to 15°, and a side rake of about 10°. He finds especially useful a new copper-cushioned turning tool on the nether surface of which a 1/32" shim of copper has been brazed. The cutting edge should be set at 1° or 2° above the center of the work, since setting at center sometimes gives the work a tendency to climb. Coolant is essential in almost all turning operations, but Mr. Jensen has found one interesting exception—the turning, and more especially the facing, of work of large diameter.

Threading and Tapping

Although fine threads can be cut in polystyrene if proper precautions are observed, they are generally inadvisable because the thermal expansivity of the material creates the danger of so tight a fit when the part is in use that it is difficult to disengage. For threads made in a tapping machine or, for that matter, by drawing the rod through the lathe headstock, as well as for taps made in the tapping machine, standard taps and dies of high-speed steel may be used. For external threads of the American coarse series on rod diameters up to ¼" the spindle speed should be 28 rpm. For rod diameters from ½" up, it is generally preferable to use a threading tool on a lathe set-up. In this case spindle speeds may go up to about 685 rpm, depending on the length of the thread and the skill of the operator. The more adept the operator at retracting the tool at the end of the cut, that is, before the cut overreaches its terminus, the more rapidly the spindle may be permitted to operate.

In tapping with standard taps, a 3-flute tap is preferable because it allows more clearance for chips than the 4-flute tool. Spindle speed should be 110 rpm. Large diameters may be made with a boring bar operating at speeds up to 685 rpm, under the same considerations as those obtaining for use of the threading tool.

For internal and external threading of large diameters, the thread milling machine or a lathe grinding attachment set up for thread milling can be provided with a high-speed-steel cutter with a cutting edge shaped to produce the desired thread. There are two operating speeds involved in this type of operation, that of the cutter and that of the

(*Continued on page* 104)

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Fungi starting a "field holiday" on unprotected insulation of a combat ship's main battery switch wires

Protecting Electronic Equipment from Fungi

Plastics resistant to fungus attack made a vital contribution to the war-time battle against this devastating tropical enemy

By Philip Pollack

THE problem of resistance of plastics to fungi of various kinds came sharply to the fore as a result of war requirements in Europe, Africa, and the Far East. The depredations of these parasitic growths on radar and electronic equipment in general caused electrical breakdowns and threatened the parts with rot and decay. Until recently, coils and parts were immersed in molten wax but this offered little protection. At high temperatures, like those prevailing in tropical regions, the wax would melt and run out, giving the fungi a field holiday.

A Pest "Blitz"

How thoroughly these pests do their work was revealed recently in an interview with Howard Nechamkin, research scientist of Brooklyn, N. Y., who has pioneered in the formulation of new plastics as protection for electronic equipment. Experience showed they attack almost everything—oils, waxes, many plastics, and wood cellulosic materials. So powerful and fast-moving are these fungi that they will invade and completely over-run instruments and cabinets in a period of 24 hr. In the tropics, a man taking his shoes off may find his feet covered with the green mold in a few

Parasitic growths are amazingly destructive and swift-acting

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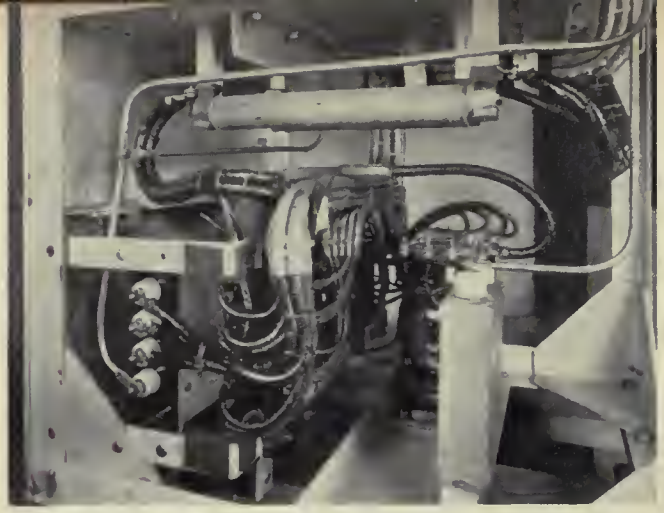
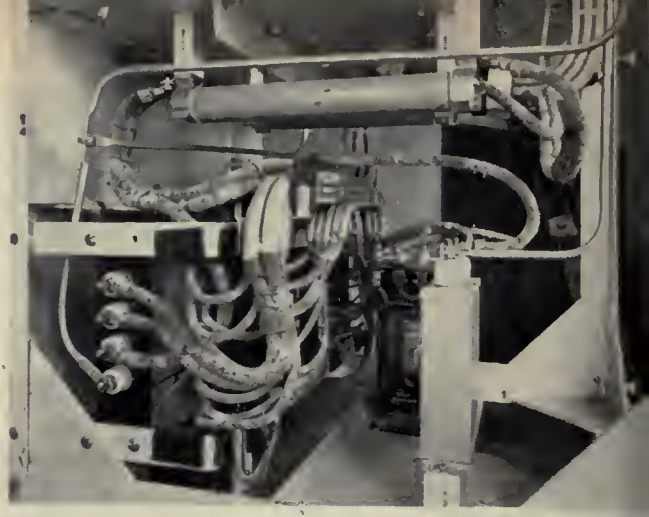
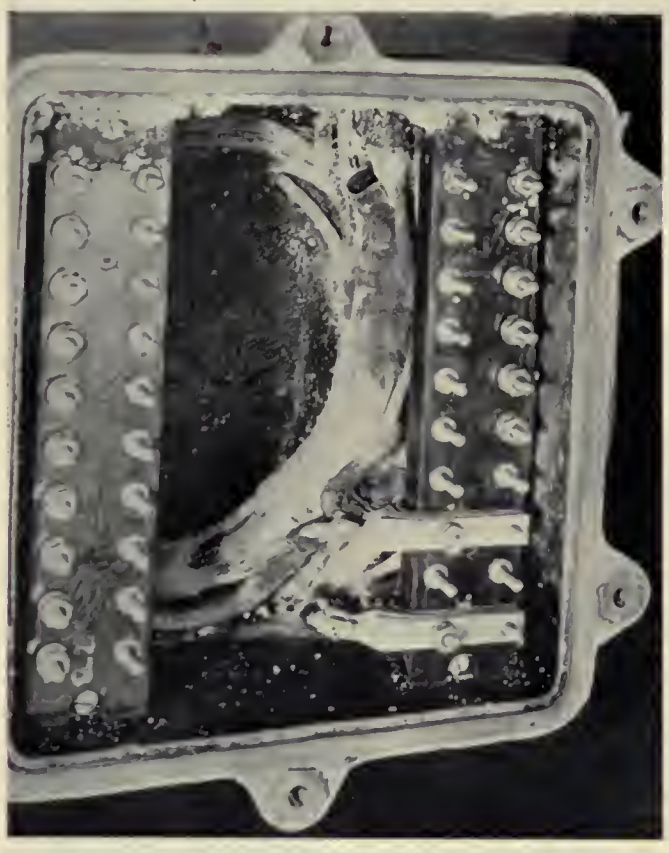
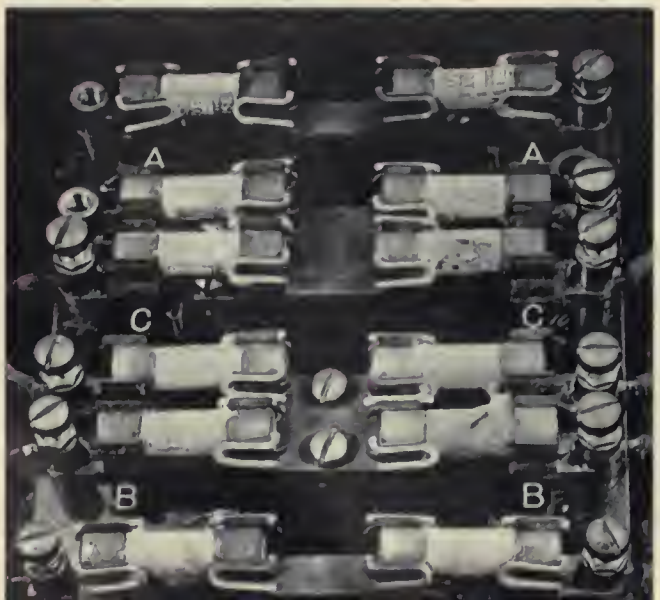




The merits of fungus-resistant plastics "tropicalization" are illustrated by treated equipment (left) and untreated (right)



Attacks on wire connection box above and switch box below may cause short circuiting, arcing, or sparking



hours. In Borneo, according to Nechamkin, it is hard to keep the mold off the body as it grows quickly in the ears and under the finger-nails.

Fungi damage the equipment in two ways: by causing short circuiting, arcing and sparking, thus disabling or seriously interfering with efficient functioning; or by attacking it directly, discoloring the surfaces, pitting and covering them with cottony fluff or etching them with spider-web lines.

Research pointed to plastics as a solution to the problem of protection. However, special kinds had to be developed to meet requirements of combat service, in addition to fungus resistance. Again, some plastics are resistant in themselves but lose this property when compounded with certain fillers or plasticizers. Some are highly resistant only when free from dust; they succumb to the pests when covered with a film, owing to the action of metabolic byproducts of the fungus as it feeds on the dust.

In general, the degree of resistance against fungi by a plastics is directly proportional to its degree of water-resistance. Thus cellulose acetate butyrate, having slightly greater water resistance than cellulose acetate, for example, has relatively greater fungus resistance. From this viewpoint, polystyrene, having a moisture absorption of zero, is ideal, as it is practically immune to fungus attacks. This is true even when it is covered with a film of dust. However, it has a comparatively low softening point and, as electronic equipment is often exposed to higher temperatures in the tropics, its usefulness in this regard is limited. Unfilled vinyl resins have been found satisfactory from the viewpoint of fungus resistance—also, phenol formaldehyde, when no filler is used, and melamine formaldehyde.

Nechamkin emphasized the fact that laminations and fillers of linen, cotton, wood, or wood flour are subject to attacks by the molds in spite of the high resistance of the plastics with which they are used. If fillers must be used, he added, chopped up asbestos fibers, mica dust, or glass should be utilized, as these materials are not vulnerable.

How do fungi operate in their attacks on materials? There are two methods or "mechanisms of deterioration," to use Nechamkin's phrase—and the plastics safeguard must be proof against both. The fungus may live directly off the surface of the equipment, as a fly is nourished in a bowl of soup. Coming in contact with hospitable material like cellulose derivative substances, it sends out tiny roots into the bed of "nutriment." By means of enzymes which it secretes, it actually feeds on bits of the hard surface, which it ingests and absorbs. Rayons and cellulosic plastics in particular are subject to this kind of attack.

Very recently, high acetyl cellulose was developed to withstand these depredations. While satisfactory in this and

(*Continued on page 96*)

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Deck tent and bumper covers typify marine uses for "Koroseal" coated cloth

Plastics in Boats

By Houlder Hudgins
Hudgins & Ratsey

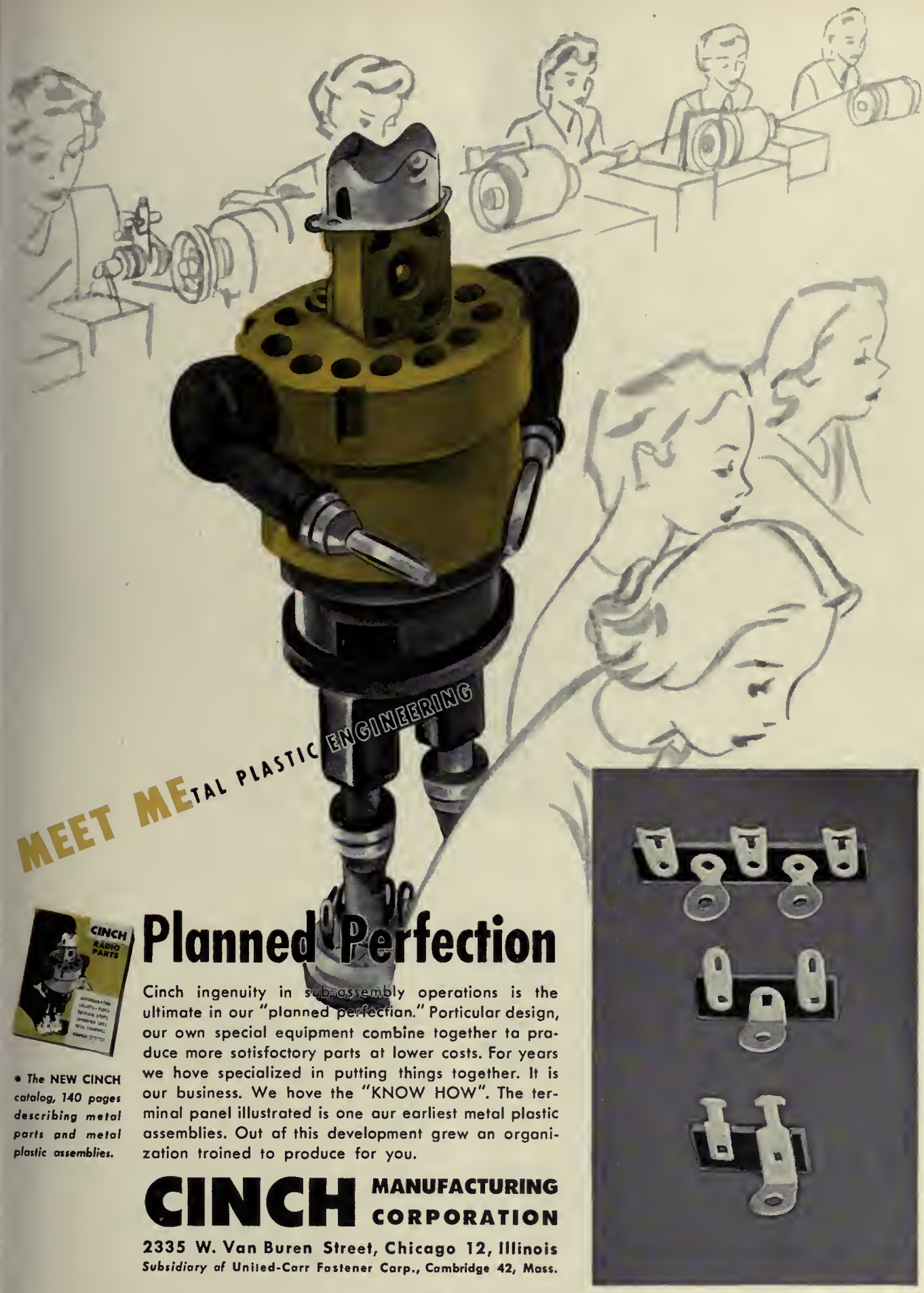
Vinyls protect cloth from water, chemicals, fire, mildew, rot; give permanency of form

ONE day in June of this year, a PBY airplane circled around the United States Naval Air Station at Lakehurst, New Jersey, and headed out for sea. Suddenly, observers saw an 18 foot life-boat bail out under a parachute. This was the first production model of Navy air-borne lifeboats furnished by Ratsey & Lapthorne, a company which began manufacturing sails in England in 1790. And the sails, covers and canvas "sea anchors" of the boat were coated with *Koroseal,* a plasticized polyvinyl chloride material.

This plastics coating has a long range of home and industrial uses, because of its resistance to water, chemicals and fire, and its dimensional stability. During the war it was drafted into the Navy and marine industry, for which its properties are peculiarly adaptable. This comparatively new application was largely initiated by our company, which was the first to use it as a coating for sails. We also apply it to boat covers, parachute packs, sail covers and all fabrics and canvas on board ship. Most of our work has been concentrated on air-borne rescue boats, some of them 35 foot dinghies, for the United States Army Air Corps. Marine application has been largely experimental and limited by the high priority of the plastics, but the excellent results already achieved point to expanding post-war uses in this field in commercial shipping and in yachting.

A Better Product

The need for plastics coating is based on the limitations of ordinary canvas duck under marine conditions. This material mildews and rots quite easily, burns freely as a rule, discolors badly due to ageing and cannot be easily cleaned. All these deficiencies are largely overcome by a vinyl resin coating, which is mildew-proof, rot-proof, water-proof, highly fire-resistant and not affected by alkalies, acids, soaps or common household cleansing fluids. In addition, the coating is estimated to increase the tensile strength of the



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fabric by 50%, which means greater sailing efficiency and greater economy, making possible as it does the use of lighter fabrics.

For commercial shipping, the plastics coating has a wide variety of applications. All boats become soaking wet in bad weather. When a storm breaks after a long dry spell, water leaks down boat-runs and companionways into galleys and cabins. The plastics coating is needed to protect upholstery from wetness, but it is also needed for the covering of boxes and binnacles. Again, the famed oilskins of the whalers offer little protection against dampness. Where they get stuck to the body, water seeps through the pores by capillary action. The plasticized polyvinyl chloride resin coating is non-porous and waterproof. It makes "foul weather clothing," as the Navy calls it, flexible in any weather, keeping the men warm and dry. Neither does it crack in cold weather nor get soft and tacky in warm. Coated garments are lighter than rubber garments and will not oxidize, peel or crack.

Advantages Are Many

Similarly, upholstery in the cabins, if coated with the plastics, will not wash out or become hard or brittle. Draperies will not get soft or sticky even if folded or rolled up while wet, nor will they yellow appreciably with age. The coating means economy as the years pass, for it results in longer wear to interior decoration fabrics. It is valuable for heavy weather cloths such as tarpaulins, hatch covers, boat covers, life preserver covers, windbreaks surrounding the rails, awnings and deck covers. It is needed also for utility interior fabrics like mattress and spring covers . In short, whatever fabric is used on deck, below deck or above deck is a fit subject for treatment by *Koroseal, Saran, Chemaco Vinyl,* and similar coatings to resist mildew, fire and other hazards of the marine industry.

Another application is on life preserver covers for kapok pillows in the life-preserver jackets that are worn over the outer clothing on board ship. The edges of the covers are heat-sealed instead of stitched together, so that the seams are water-tight.

Yachting and sailboat racing are soon expected to return to their pre-war level of popularity, and for this purpose, also, the plastics coating offers important advantages. It should be widely used for sails, sail covers, deck covers, hatch covers, winter covers, etc., as well as for heavy weather clothing and duffle bags. In addition to being waterproof, it is mothproof and windproof. Yachtsmen are particularly interested in the fact that it can be easily cleansed with soap and water and that it is resistant to sunlight and oxidation. In addition, the coating should be much in demand for cockpit cushions, berths, bunks and wherever upholstery is used.

Racing Sails

The only question regarding its application is in the matter of racing sails. While it is excellent for working sails, some yachting authorities believe that it makes the canvas too elastic so that fullness or bellying takes place in the middle of the sail instead of in the forward third, which is the desirable position for a racing sail. However, this claim was disputed by one racing enthusiast who recently won three races with *Koroseal*-coated sails on his boat. He observed that the waterproof quality of the plastics offered a decided advantage when the boat tacked and the sail dipped into the water.

Another yachtsman interviewed pointed out that the coating presents a smooth, non-porous surface to the wind, making the sail superior to ordinary uncoated canvas, which is porous. They all agreed that the fire-resistant factor is not the most important feature in this connection, as racing

(*Continued on page* 106)

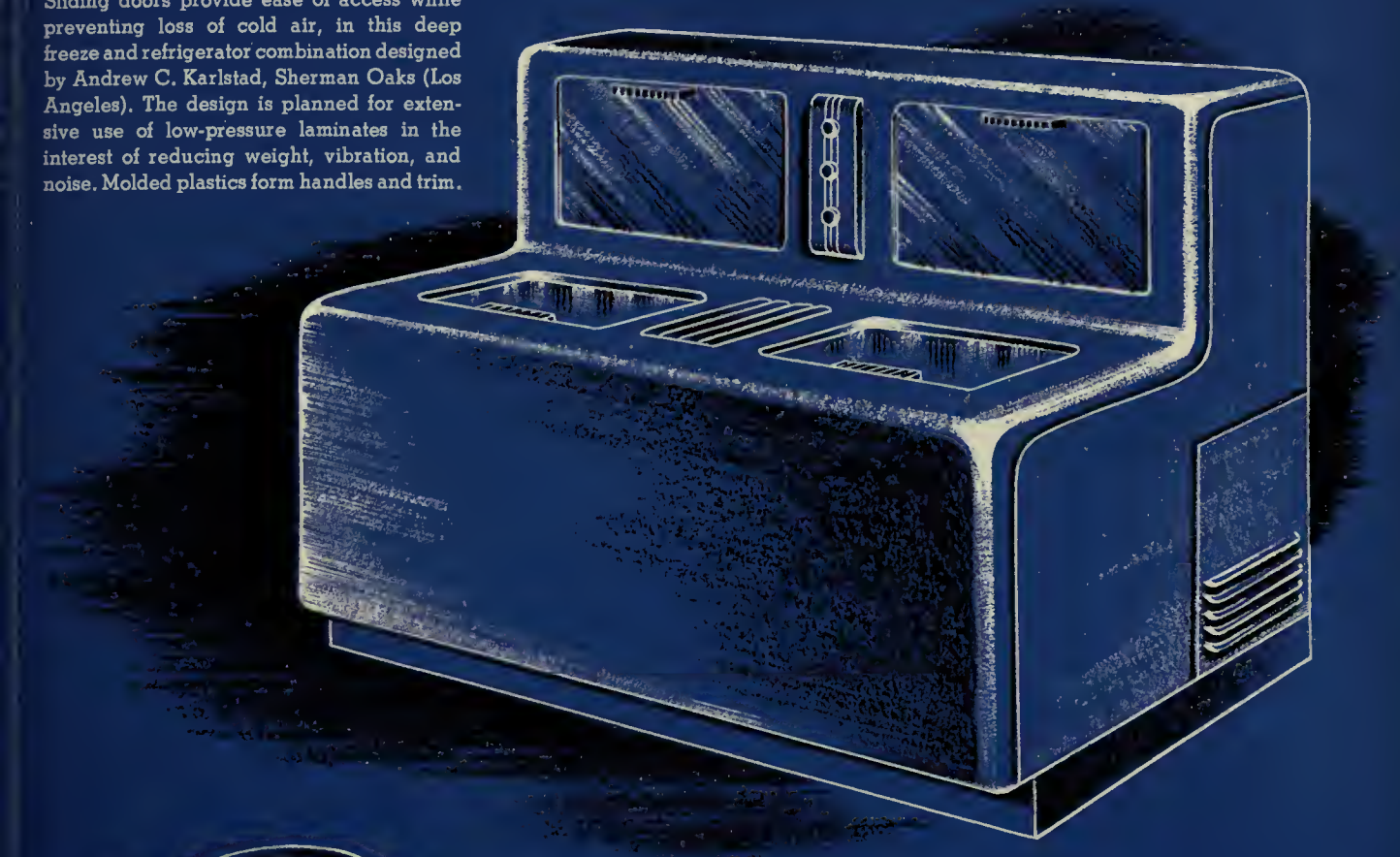
ON THE DRAFTING BOARD

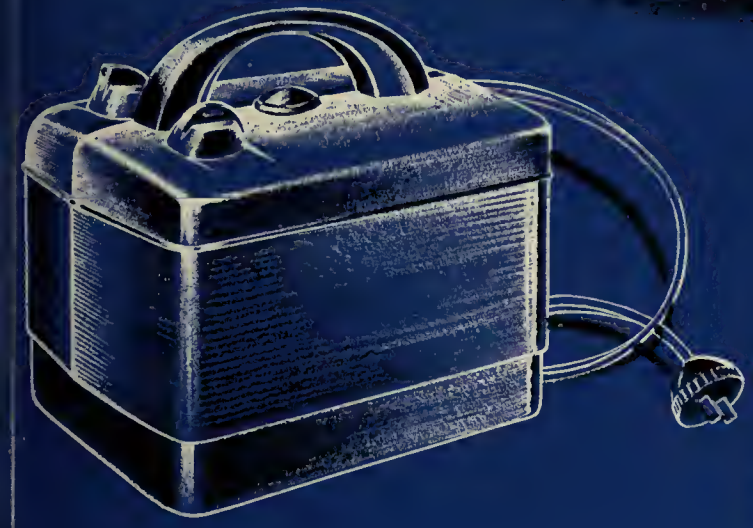
Drawings by Julian Krupa, *plastics* Art Staff

A Presentation of the Potential Applications of Plastics as Visualized by Industrial Designers

(*plastics* welcomes designers' contributions to this department)

Sliding doors provide ease of access while preventing loss of cold air, in this deep freeze and refrigerator combination designed by Andrew C. Karlstad, Sherman Oaks (Los Angeles). The design is planned for extensive use of low-pressure laminates in the interest of reducing weight, vibration, and noise. Molded plastics form handles and trim.





Eye-appeal and utility are deftly combined in the electric vaporizer designed by Brooks Stevens, of Milwaukee, Wis. Raymond Laboratories, Inc., used a phenolic molding compound to form this completely automatic unit for the Spartan Co., Minneapolis.

Smoothly flowing lines and economy of space requirements characterize this design for a plastics telephone instrument, by George Roos, Chicago. Contrasting shades of either clear or opaque plastics form the "push-buttons" in calling device, and supply a decorative interest.

New Motifs in Lampshades

The beauty of natural flowers is preserved and held permanently between two sheets of cellulose acetate

Wheat and flowers make shade pattern at left, with crystal lamp base. Other lamp features pansies, acrylic base

THE delicate beauty of natural flowers is literally pressed into service in a line of lamp shades designed by Rose Simon, Baltimore, which combines them with sturdy, washable *Lumarith* cellulose acetate. The flowers, chemically treated to prevent embrittlement, are pressed between two sheets of the plastics. Miss Simon also uses the wheat plant in the same way for the excellent decorative patterns which can be achieved with it. That the treatment is effective is evidenced by the fact that early models made by Miss Simon four years ago are still in good condition.

The colors of flowers show up strikingly in the glow of a lighted lamp, and there is no limit to the color range. Against a background of off-white acetate, anything from pale yellow primrose to the red and purple bracts of Bougainvilleas stands out. There is also the possibility of achieving subtle harmonies by using tinted sheets of *Lumarith,* when tinted material is available. Miss Simon also combines several kinds of plants in one shade, as illustrated.

Since shades can be made to order, they can be fitted to any size lamp, from the popular small boudoir model to larger table lamps. The shades range in price from $4.95 for a 4″ model to $25 for a 17″ model. END

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ENGINEERING — News Letter —

By LEWIS WINNER
Market Research Engineer

Plastics Standardization

With plastics now firmly entrenched as a major factor in our national economy, it has become more necessary than ever to minimize and in most instances delete all guesswork approaches to plastics development and production. Efforts in this direction were initiated prior to the war with standardization test and development programs . . . programs that provided an evaluation of product uniformity.

During the war the program was substantially expanded and today the plastics industry has an excellent standardization format to follow.[1] It is, for instance, possible to check for product uniformity of phenolic laminated sheets with six tests. These are: Thread count and ply thickness; acetone extractable matter; water absorption; dielectric strength parallel with laminations after immersion in water; density; and hot Rockwell hardness.

The thread count and ply thickness test, generally used for fabric-base grades of material, indicates the variations in count or weight of the fabric base used or any radical changes in the resin content of the material. The acetone extractable matter test reveals the change in cure of the material, change in type of resin used, or the presence of any acetone extractable agents. In the water absorption test, we learn of the changes in resin content, type of resin or raw materials used, or the degree of impregnation sufficient to cause changes in water absorption. The dielectric strength test reveals the presence of conducting materials, overcure, or high moisture content in treated materials before pressing. The density test is quite interesting in that it discloses the changes in the type of resin used, resin content, character of the sheet filler material used, as well as any additional pigments that might have been included. The test also reveals if there is any insufficient molding pressure, although this condition is usually rare in sheet materials. The hot Rockwell hardness test indicates any undercuring of material or the presence of plasticisers.

In the thread count test, a textile thread counter or a 4-to 6-power microscope with a ½" or 1" square opening in the base is generally used. To test a specimen for Rockwell hardness, material 1" square and ¼" thick is suggested. In heating the material, the specimens are placed one layer deep in a constant temperature oven at 135° ±2°C. Heating periods vary from 15 to 30 min depending upon the thickness of the material.

Conditioning Procedure

A tentative method for the conditioning of plastics for testing purposes has also been evolved. Two procedures have been suggested by the standards' authority. In the first procedure ¼" test specimens are conditioned in a standard laboratory atmosphere for a minimum of 40 hours. If the test specimens are larger, a minimum of 88 hrs is recommended. This procedure is suggested for thermoplastics.

The second procedure, recommended for thermosetting materials, provides for a conditioning of the test specimens for a 48-hr period in a circulation air oven at a temperature of 50° ± 3° C or 122° ± 5.4° F. After this heating period it is necessary to remove the specimen from the oven and cool to a standard room temperature in a desiccator, over anhydrous calcium chloride, for about 16 hrs. Incidentally, the standard room temperature usually is in a range of 20° to 30° C or 68° to 86° F.

The deformation of plastics under load is quite an important

[1]ASTM Standards on Electrical Insulating Materials, ASTM Committee D-9; 1945.

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ctor. Accordingly, several methods of test have been sug-sted. The methods recommended cover rigid and non-rigid aterials. According to ASTM deformation is the dimensional ange due almost entirely to flow, and the dimensional change e to a combination of flow and shrinkage caused by a loss of ater or other volatile matter.

Methyl methacrylate and polystyrene are typical of the mate-als that deform almost entirely by flow. Materials that deform a combination of flow and shrinkage include phenolic lami-ated fiber, vulcanized fiber, cellulose acetate and cellulose ace-te butyrate.

est Methods

The rigid plastics test method involves, basically, a parallel late or constant force system. That is, a test specimen is con-itioned and then placed between the parallel plates of a constant orce device, the thickness being observed over a required period t a known temperature. The test machine usually exerts a con-ant force of 250, 500 and 1000 lb ± 1% between parallel anvils. n the non-rigid plastics test, involving materials approximately " in thickness, the test method is essentially the same as that or the rigid materials, except that the pressure is 100 psi. The eriod of test for deformation is 3 hrs.

To test the flexural characteristics of rigid plastics a cali-rated test device which can be operated at a constant rate of rosshead movement is recommended. The stiffness of this ma-hine must be such that the total elastic deformation does ot exceed 1% of the total deflection of the test specimen. n writing a report on this property the ASTM committee rec-mmends that the following data be included: Direction of cut-ing and loading specimens; conditioning procedure; depth and idth of specimen; span length; span-depth ratio; modulus of upture; modulus of elasticity in bending, in lbs per sq in.

The Rockwell hardness test has also been standardized by sing the flat anvil method and conducting all tests at a tempera-ure of 25° ± 2° C.

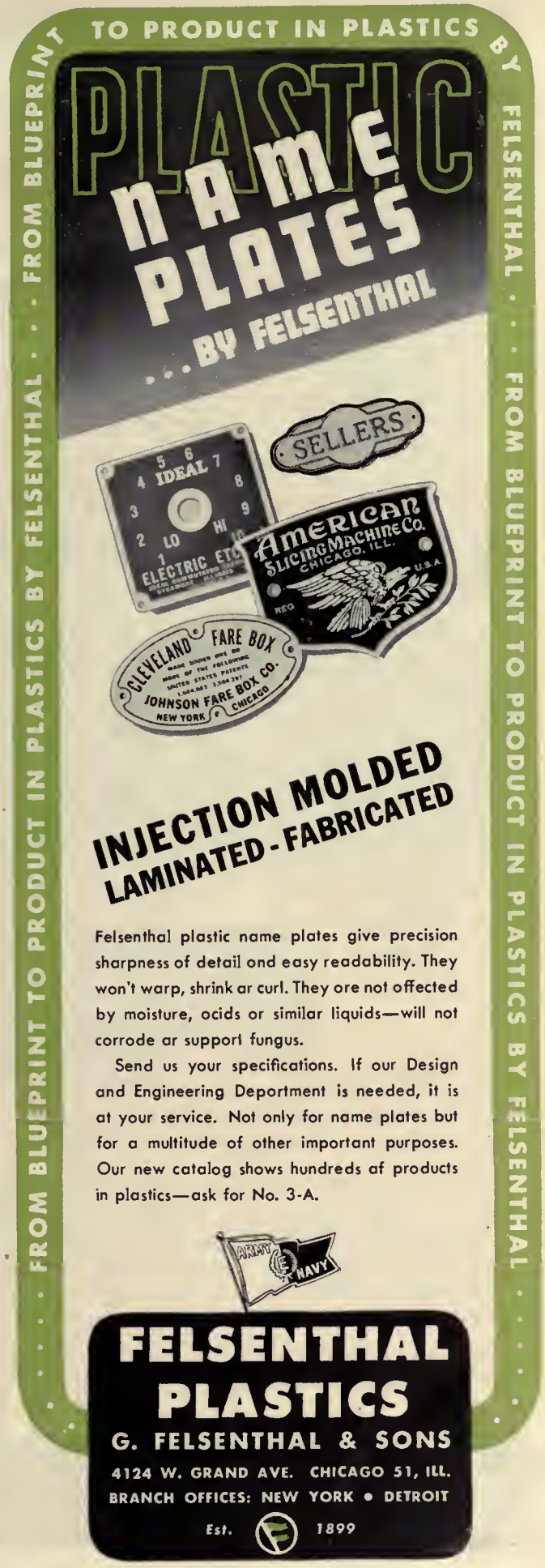
Another physical test which is quite important in plastics is hat involving impact resistance. Such test is intended to deter-nine the relative susceptibility to fracture by shock, of plastics, s indicated by the energy expended by a standard pendulum ype impact machine in breaking a specimen in one blow.

Two types of impact machines can be used. One is the canti-ever beam or Izod method where the specimen is held as a antilever beam, usually vertical, and then broken by a blow delivered at a fixed distance from the edge of the specimen clamp. A notched specimen is required. This notch is intended o produce a standard degree of stress concentration. The other method is a beam or Charpy test where the specimen is sup-ported as a simple beam, usually horizontal, and broken by a blow delivered midway between the supports. Here the speci-men can be plain or notched.

Probably one of the most interesting tests of plastics is that involving tensile properties. There are nine factors involved in this test: Tensile stress; extension; strain or unit extension; ten-sile strength; percentage elongation; mean rate of stressing; mean rate of straining; elastic modulus or Young's modulus; and the offset yield stress. These terms have been defined and stand-ardized by the ASTM.

Tensile strength, for instance, has been defined as the maxi-mum tensile load per unit area of original cross-section, within the gage boundaries, required to break a test specimen. It is expressed in lb per sq in. The true ultimate or tensile strength is the tensile load per unit of minimum cross-sectional area, measured at the moment of rupture, required to break a test specimen. This is also expressed in lb per sq in. Extension is defined as the change in length produced in a longitudinal sec-tion of a test specimen, measured between fixed gage points, by a tensile load. This is expressed in inches. Strain or unit ex-tension is the change in length per unit of original length. This is expressed as a dimensionalless ratio. The elastic modulus has been defined as the ratio within the elastic limit of stress to cor-responding strain. This is expressed in lb per sq in.

A standard method of test for water absorption has also been prepared. This method is intended to apply to all types of plas-tics including cast, hot-molded and cold-molded resinous prod-ucts, and both homogeneous and laminated plastics in rod and tube form, and in sheets .005" or greater in thickness. The test serves as a guide to reveal the proportion of water absorbed by the material. END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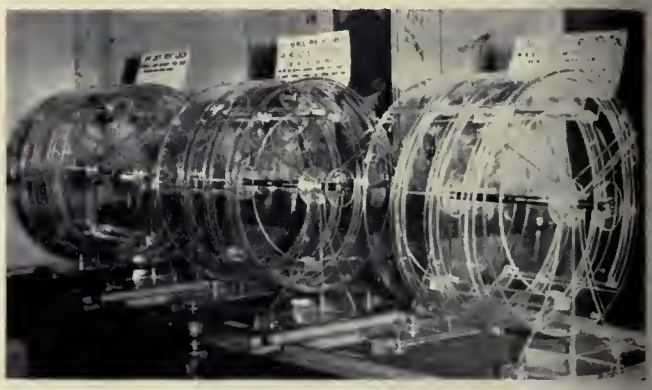
Acrylics Go to Court



Judge followed disputed points by referring to models

By Phil Buskirk

ADD another role to the already impressive list of applications for the versatile acrylics: expert witness. During the week of September 17 three working-models of clear acrylic went to the San Francisco Federal District Court on behalf of the defendant. They were a big help to counsel for the defendant in presenting the issues.

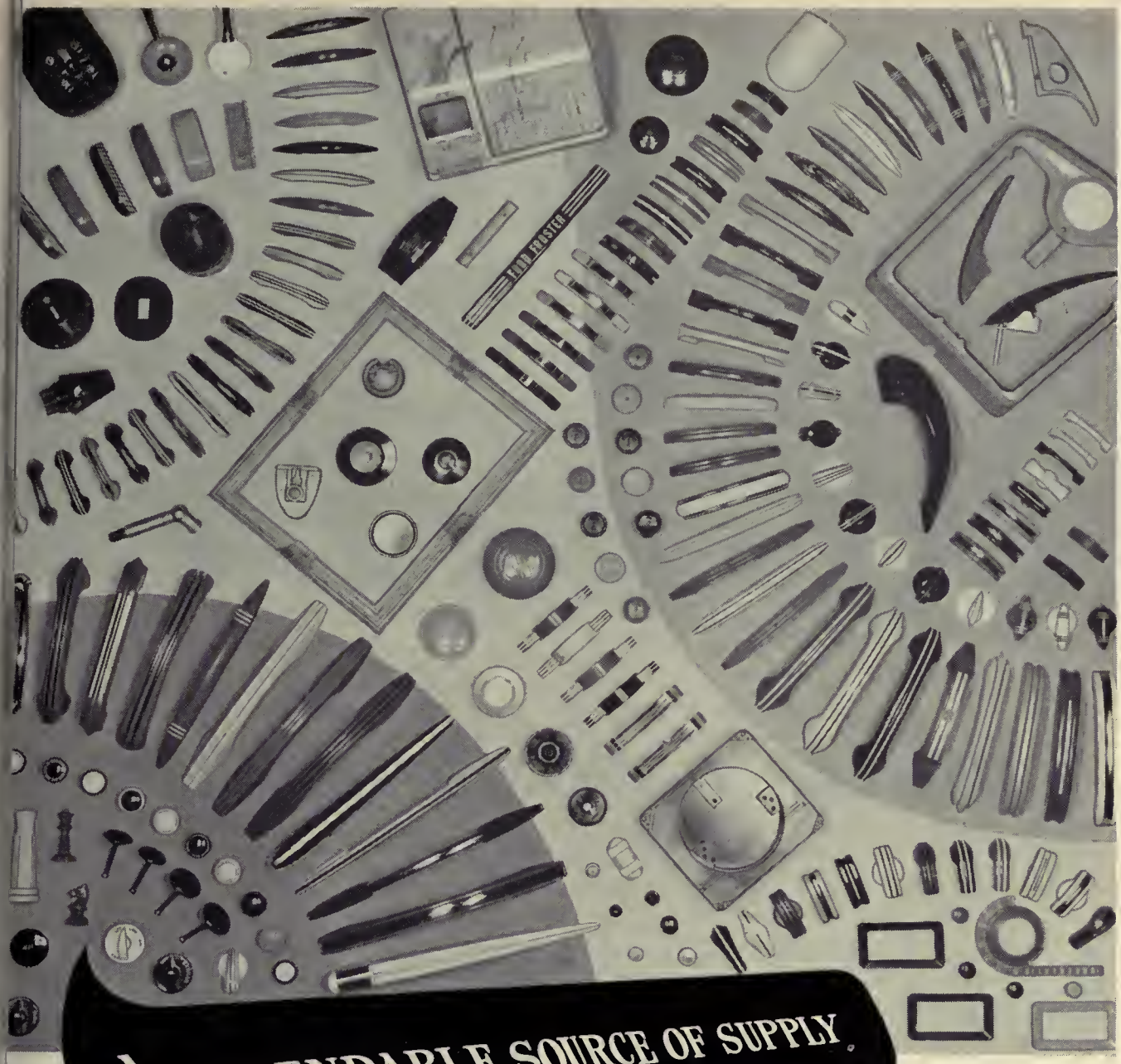
Attorneys say that in every patent case the major problem is in a few minutes to explain the operation of the device in suit to a judge who has probably never heard of it. In this case the device was an automatic pressure cooker used in processing canned foods. All the action occurs inside a steel drum. Without the use of a transparent plastics it would have been impossible to demonstrate visually what was happening. The plaintiff, Food Machinery Corp., alleged that Pacific Can Co. was infringing on its patent while the defense claimed that the patent in suit was invalid because the patented device had been shown in another patent 10 years earlier.

To back up their claim Pacific Can and its attorneys contracted with Ferdinand T. Kebely of K-Plastix to fabricate three models—one for each device involved. He chose acrylics for all the parts except the axles, which are made of *Phenolite*. One model showed the device of the patent in suit, which in this case was identical with an earlier prior art patent. Another showed an 1899 prior art device. The third model illustrated the device of the defendant.

Fine parallel red lines on the outside of each drum permitted easy observation of the forward progress of a sample can through each device. Colored inserts in the tracks showed how this is accomplished. Briefly, each device consists of a drum, a reel with longitudinal pockets rotating therein, and a T cross-section can-guide track mounted in the drum around the reel. The object is to propel the cans through the drum as the cooking takes place. Each can is placed in a pocket; then as the reel rotates the pocket, the track pushes the can endwise.

The models allowed defendant's counsel to demonstrate visually every disputed point. Judge Michael Roche said he had never seen such models used before, and patent lawyers not involved in the case came to see them in operation.

A verdict, other than the informal one that plastics had their place in court, has not yet been handed down. END



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NATIONAL LOCK COMPANY

PLASTICS DIVISION . . . ROCKFORD, ILLINOIS

This window display featuring the acrylics presents a stimulating scene to the person in search of a hobby

SELLING THE HOBBYIST

By Margarita Dobert

A WOUNDED GI was flat on his back in the hospital for months. He began to whittle away at a piece of *Plexiglas* which had been part of a shot-up bomber his buddies had broken up. He tried all sorts of shapes and uses until he hit upon the idea of making a new kind of picture frame. Instead of making the frame completely surround the picture, he cut out two little figures which held the picture between them. Now out of the hospital with a disability, he has developed his hobby into a profitable business.

A naval lieutenant was attracted by a round piece of *Catalin* cast phenolic. He fashioned it into a lampbase and gave it to his wife as a birthday present. The neighbors came and admired it, and soon the officer found himself turning out lamps in his spare time and selling them at $20.00 apiece. The chances of his going back to teaching school in Texas after his discharge are pretty slim, now that he has found so much satisfaction in working out his ideas with his own hands. Furthermore, he has an offer from the makers of home workshop equipment to write a manual telling how to work with plastics in the home workshop.

Making Knife Handles

A beauty shop operator in Orland, California, experimented with plastics to make handles for the hunting knives which her husband collects as a hobby. She combined beautifully colored plastics with steel and aluminum to produce beautiful knives with striking handles. Now she looks forward to the day when she can give up "twisting hair" and really have fun—and perhaps earn a few dollars besides—

Stock awaiting transformation into "hobby ideas"

making handles for hunting knives and carving sets and also making other beautiful articles in plastics.

The store where these people get supplies, inspiration, instruction, and also an outlet for their products is in Georgetown, the oldest part of Washington, D. C. Samuel Kostolefsky, the originator and manager of the Hobby Crafts Plastics Corporation, served in World War I. He saw many veterans come home with new skills and ideas. Some of them wanted to continue, for their own amusement, crafts they had learned in hospital wards; others saw opportunities for future jobs in the skills they had acquired. Kostolefsky, or "Kosto" as he is known to many veterans and civilians, set out to provide both a source of supply and an outlet for their products. The present U-Make-It shop was organized with this dual purpose in mind and could well be prophetic of a movement which may spread all over the country.

The people who patronize this shop come from all walks of life. For example, there is the office girl who wants to make herself a pair of earrings from the colorful plastics displayed in the windows; the Wave who started handicraft projects in her barrack; the veteran who learned about plastics through occupational therapy; and the Congressman who relaxes from affairs of state by working with plastics in his basement workshop at night.

The questions they ask the competent proprietor are endless: "What is the difference between plastics and *Lumarith?*" "Do you melt the stuff and pour it like plaster of Paris?" "What do you think of this idea for a gadget which, if it works, will sell a million the first year? Can I make it at home and how much will you charge me for a model?" "How about a coffee table made of two-inch *Plexiglas* with legs of limed oak; it should be stunning, don't you think?" "Where can I get a course in plastics?" "At what temperature can you bend *Lucite?*" "Can this stuff be used back of sink or kitchen stove?" "Can I mold drinking cups that the children won't break?" "What are the proper cements and solvents and how do you polish it and what do you use for getting the scratch marks out of it?"

War-Time Idea

The idea of the U-Make-It shop was born in wartime, when plastics for civilian use was scarce. In December, 1944, an ad in a magazine offered five tons of plastics for sale. Kostolefsky answered it but did not hear anything until February, when he was advised that New York was the point of sale. He went there and found that a manufacturer of ornaments for ladies' bags was selling out five tons of plastics consisting entirely of buckles — round buckles, flat buckles, square buckles, hexagon buckles, pentagon buckles, octagon buckles, but buckles all of them. Kostolefsky was determined to get plastics and, since the buckles were made of plastics, he bought them.

After a store had been rented and the buckles supplemented with plastics of a few other shapes, "Kosto" set to work trying to fill the demand for plastics by people who wanted to make at home the things which, because of wartime shortages, they could not buy: ash trays, cigarette boxes, tables, dinner ware, trays, and gifts of all sorts. Consequently, he developed the Kosto-Plasti-Kit, which contains pieces of *Catalin* cast phenolic, *Lucite* and *Plexiglas,* and polystyrene, together with dyes, cement, and instructions how to use them. Soon flat sheets became picture frames, straight rods changed into towel racks, and buckles became toy lampposts. All the tools people needed—for example, fret saws and files—were usually already in their home.

Lamps Make a Hit

Plastics lamps made with these kits were such a hit that special U-Make-It Lamp Kits were made up. Some of the

"Kosto" shows hobbyist-made articles to interested customer

lamps were made with solid columns; for other types the plastics were cut up into blocks and put together in complementary or contrasting colors. Matched with flat sheets of *Catalin, Plexiglas,* or wood as bases, they turned into handsome modern table lamps.

Besides lamps there are many other uses, some of them quite novel, to which plastics are put by the clientele "Kosto" has built up. The Arlington County School began to use plastics in its workshop, first as a substitute, now as an important material in its own right. Another customer—a young one—bought a piece of *Tenite II* tubing and soon came back for more. He was using it as a peashooter and had to equip the members of his gang. Somebody thought of transferring a picture on to a piece of acrylic and then cutting it out, thus making an attractive letter opener. A doctor makes his own acrylic darts for hunting. This is in line with experiments the Navy undertook during the war in developing a dart gun for jungle warfare. The dart gun, which shoots a plastics dart, pre-

Returned veteran takes up in earnest what began as a hobby

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sumably under air pressure and without a sound, was designed for hunting and defense against wild animals in jungle warfare, since the detonation of a bullet would give the hunter away.

"Kosto," an ex-service man, employs ex-service men and others who do development work in various government plants. One of these is Ray Meier, a well-known model maker and craftsman employed at the Washington Navy Yard, who is now associated with the U-Make-It shop as chief of experimental and development work. He sorts the many ideas which come into this "Crackpots' Paradise" and either makes them work or convinces the inventor that his ideas are wrong. And that is no small job, because the man who wants "lamented plastics" and the one who wants "transplanted plastics" and the one who knows all about "Ezins" and the woman who wants to preserve her grandmother's old lace in plastics and the one who wants "windows" for a doll house and the physician who has invented a new and revolutionary atomizer—all these and many more are hard to convince and form a large and growing consumer class for plastics.

Workshop in Basement

Not only curiousity-seekers and hobbyists, but manufacturers who want to experiment with new products and need models, and workshop owners who like to try out new materials frequent the shop. Their need for information and their desire to see how plastics can be worked led to the installation of a workshop in the shop's basement, complete with bench saw, jig saw, lathe, band saw, grinders, and buffers. Evening demonstrations are held and anyone who can work with tools may pay a small fee and do his own work there. Boys in the neighborhood, first attracted by the machinery, tools, and plastics displayed in the windows, now come in and swap some of their time doing odd jobs in the shop for the right to work with the machines in the basement on their own ideas.

The latest demand is to cast liquid plastics at home. Melvin K. Young, formerly of the Glenn L. Martin Co., of Baltimore and now plastics methods engineer with the U. S. Navy Department, has developed a phenolic casting resin which, under the name of *MEL-Kast,* will be marketed by the U-Make-It-Shop. This resin will be inexpensive and can be cast in any kind of open container with a minimum of technical knowledge. Kits containing the newly developed resin, which is based on Mr. Young's experience in war production work, will contain all the materials and instruction for casting at home. Demonstrations of the material and process will be given in the U-Make-It-Shop.

The eagerness with which many amateurs now greet plastics augurs well for the future sale of plastics handicraft sets. END

Don't miss the following stimulating, informative articles in the March (Annual Directory) issue of ***plastics***

PLASTICS IN DENTISTRY

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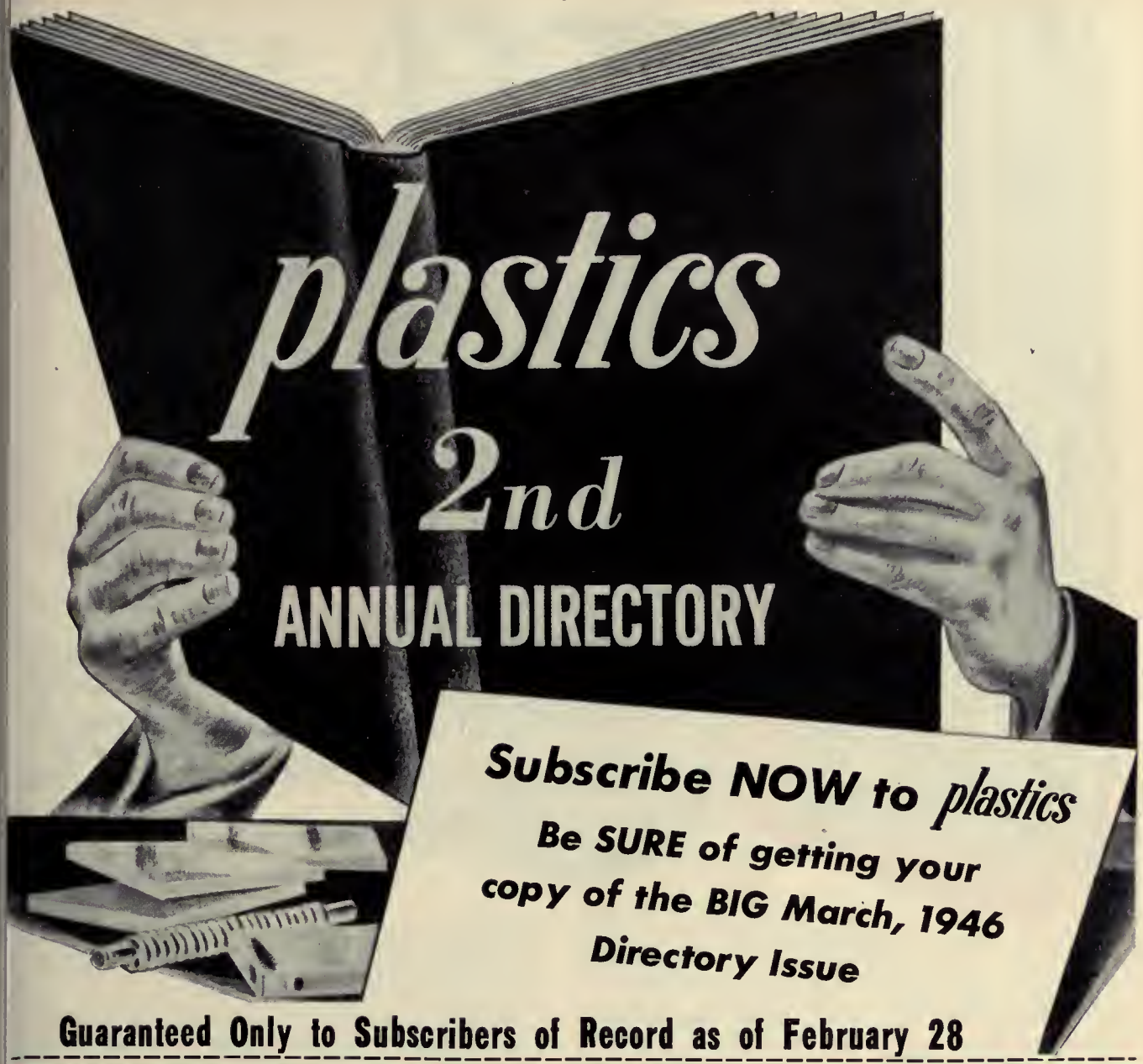

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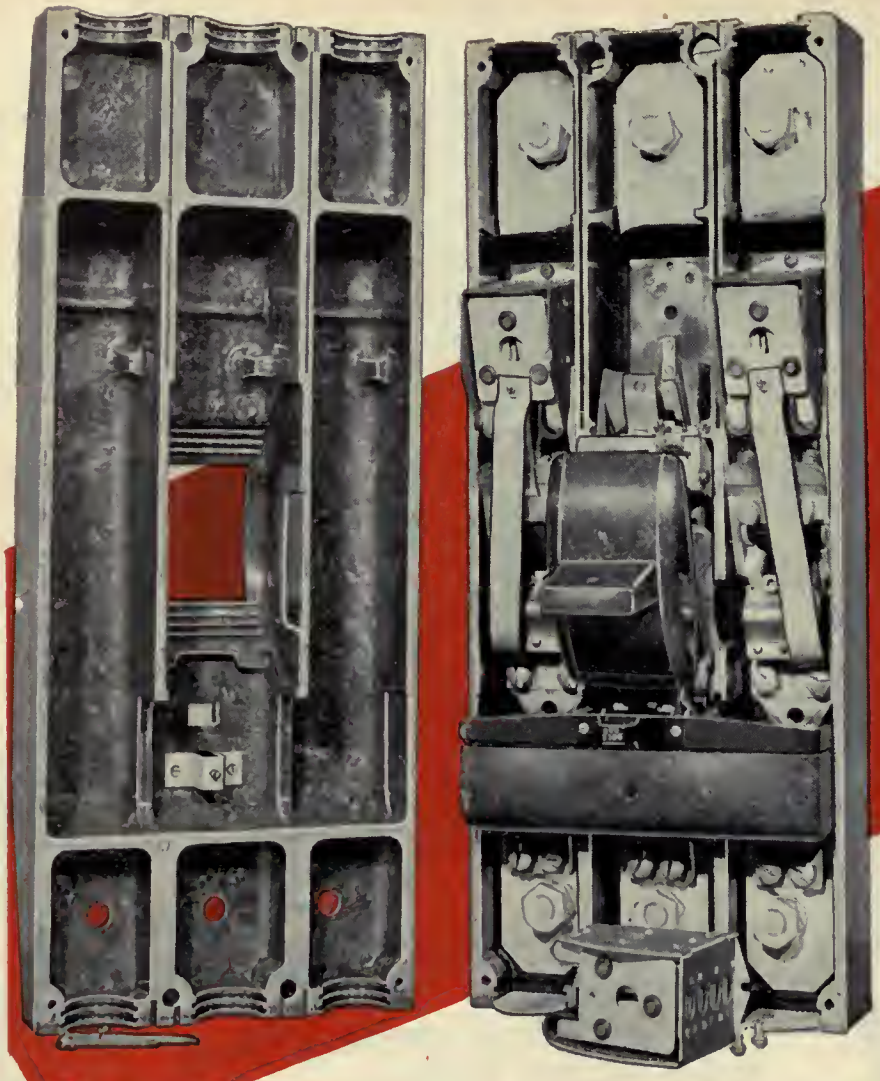

BIG

. . . But NOT TOO BIG FOR CMPC

It's the new 600 ampere I-T-E Circuit Breaker . . . 22″ long and 9″ wide . . . the housing for which was compression molded by CMPC for I-T-E Circuit Breaker Company. Rather large for a molded plastic part, but for CMPC it's just another good job well done.

A phenol formaldehyde material was used for both parts . . . housing and cover . . . because of its low coefficient of expansion, resistance to mechanical shock, freedom from warping, and excellent insulation properties.

The housing is so constructed that the individual circuit phases or poles are encased in separate compartments, the individual poles operating from a common mechanism. This, of course, called for extreme accuracy in die making, and close control in molding.

As usual, the massive molds for this housing were designed by CMPC engineers and fabricated in the CMPC tool room. Molding large plastic parts is nothing new at CMPC. We have the experience and facilities to handle most any type of plastic molding job, large or small, and a nation-wide reputation for quality and service. All of which is just another good reason for discussing your plastics molding problems with a CMPC Development Engineer. Why not talk to him now? There's no obligation!

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COMPRESSION AND INJECTION MOLDING OF ALL PLASTIC MATERIALS

WHAT'S *New* IN PLASTICS

lectronic Interval Timer

ectronic Controls, Inc.
ewark, N. J.

Announced as being itable for all applitions requiring high- accurate circuit timg, this item has time nge from 1 to 120 c in increments of 1 c.

There are two dials r time selection, one libratedin single sec nd the other in 10- c steps; dials control p switches, precision ntrol being assured y snap - positioning ep-switches, with ext values of resistance inserted in the circuit at each position, ccording to description.

Double receptacle permits timing two circuits simultaneously; ntacts are normally wired SPDT with double break and are ated at 25 amp 32VDC, 25 amp 125VAC, and 10 amp 230VAC; ntacts can be wired DPDT at correspondingly lower rating.

Cabinet size 8" by 8" by 8", 2050 thyratron tube used. High ccuracy resistors are said to assure precise timing which is ndependent of length of time that tripping push button is deressed.

Compact and easily operated, the unit is recommended by its akers for various uses, including those in induction furnaces, ndustrial ovens, plastics molding, tumbling barrels, X-ray exosures, etc. .....(464)

Marking Equipment

The Acromark Co.
Elizabeth, N. J.

Hand-operated bench marking machine *No. 924A* which is announced as possessing a number of advantages and design improvements over former model, *No. 924*. Construction has been simplified so that there are fewer moving parts, and adjustments have been provided to compensate for wear of the marking head.

Quick die-changing facility is provided, and both interchangeable and solid logotype dies may be used individually or in combinations, according to description; improved adjustment for depth of imprint, new style nesting and locating jigs allowing a greater variety of work to be marked, and high mechanical advantage permitting the machine to be used with minimum of fatigue for operators, are listed among the improved factors of this product. .....(465)

Rapid Cold-Dip Dye

Cardinal Chemical Co.
Rochester, N. Y.

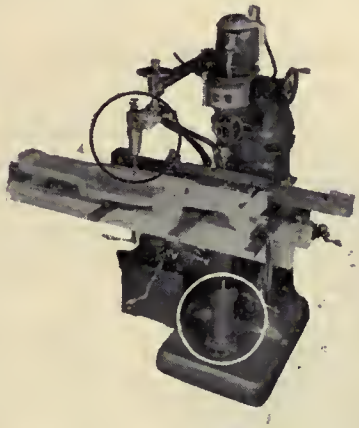
New line of liquid dye solutions in comprehensive color range, said to have very rapid dyeing rates at room temperature, for various plastics. Light tints to deep shades, having good light fastness and uniformity are claimed to be obtainable by immersing the plastics from instant dip to 3 or 4 min, and faster dyeing rates to be obtained by adding a small amount of the company's *Cardco Concentrate*.

These dye solutions are intermixable, permitting a wide variety of shades and tints.....(466)

Die Sinking Method

Turchan Follower Machine Co.
Detroit, Mich.

Recently-devised method of sinking dies by means of a vertical mill, when the dies are longer than the mill's ordinary feed travel.



The model to be duplicated and stock in which die is to be sunk are set up between parallels on the table, and when one-half of the die has been sunk, the parallels facilitate easy shifting of model and stock for sinking of the second half.

The accompanying illustration shows a vertical mill equipped with a *Turchan* hydraulic duplicating attachment, being used to sink a die for a plastics instrument panel which is more than 4 ft long.....(467)

Heat Dissipating Unit

Eastern Engineering Co.
New Haven, Conn.

Various uses, including those in high pressure mercury lamps, X-ray tubes, and induction heating units, are announced for these items which are now being manufactured for commercial heat dissipating applications.

Available in several different materials, they can be built to dissipate up to 5000 w.....(468)

Aging Bath

Precision Scientific Co.
Chicago, Ill.

Developed for use in estimating the comparative ability of rubber and other elastomeric compositions to withstand the effect of immersion in oils and liquids, this aging bath has especially useful qualities for research and development work, as a means

To simplify for our readers the task of obtaining detailed information regarding the new products, processes and trade literature described herein, ***plastics*** offers the prepaid postcard inserted here.

In rapidly-moving times such as these, keeping up with every latest development in ona's field is a "must." Facilitation of reconversion, speeded production, and the competitive driva toward lowar manufacturing costs require that all avenuas leading to a solution of these problems be explored thoroughly.

Each item in this section is keyad with a numbar, which should be enterad on tha postcard, to expedite identifying tha exact product, process or publication about which information is desirad.

of securing comparative data on which to judge service quality, for aging rubber or elastomers in air in test tubes, etc.

It has a capacity of 24 test tubes, 38 mm diam by 200 or 300 mm long, the test tubes being supported in an adjustable, stainless steel rack which rests directly in the bath. Temperature range of bath is 35 to 200° C, with an accuracy of plus or minus 1° C, according to description, and overall dimensions, including rack, are: Height, 49″; width, 24″; depth, 24″ .....(469)

Injection Molding Machine

Hy-Speed Press Co., Inc.
Chicago, Ill.

Automatic in cycle and fed by an automatic feeder, this unit casts up to 2 lb of material, is entirely electrically heated and controlled, and will cast to an area of 60 sq in. Standard pump equipment is used with solenoid control and time clock.

Weighing 5 tons, this *Hy-Speed* injection molding machine requires floor space of 36″ by 60″. The cabinet is so designed as to make all compartments accessible for adjustments and cleaning, and the machine is equipped with lights to enable the operator to observe the mold after each cast. .....(470)

New Line of Preheaters

Airtronics Mfg. Co.
Los Angeles, Calif.

Recently-announced series of *Airtronics* preheaters, incorporating ideas and improvements which the company reports were gathered from a number of molders consulted in a "requirements survey" conducted by its engineers to establish basic design for the new line.

Simplified and standardized operating controls for all models; removable, hinged inspection door at front of preheater for convenient servicing; and electrodes to accommodate wider variety of loads, are among the advantages listed for these machines, as well as established features of dual load selection, and automatic excitation regulation.

Models from 1.5 to 10 kw are included in the new series. (471)

Improved Fingerguard

Industrial Gloves Co.
Danville, Ill.

Affording practical protection of thumb and finger in buffing, polishing, grinding, punch press and assembly work, inspection, sanding, etc., a new and improved version of its *Steel-Grip* Finger Guard has been introduced by this company.

The new product, called *Superguard,* provides added protection to the wearer by means of the leather wearing surface extending two-thirds of the way around the finger, being backed by comfortably-fitting, elastic webbing; seams are well up on sides of finger, out of working zone, assuring longer service. The item is available in three sizes and materials.....(472)

Indicating Micrometer

Federal Products Corp.
Providence, R. I.

Just introduced, this micrometer, *200P-1,* incorporates a dial indicator, and can also be used as a dial indicator comparator without the necessity of setting to a master, the micrometer feature furnishing its own precision setting. Use of this item as a comparator is said to make it highly advantageous for short runs and equally valuable as a direct reading instrument where frequent changes occur in dimensions and tolerances.

Lightness of weight, ease of handling and of reading, are among the advantages listed for this instrument by its makers. Indicating dial is integral with the frame and is provided with tolerance hands which can be easily set with wrench furnished with the gage. Micrometer scale and the indicating dial are graduated in .0001″ and measuring capacity is 0—1″.....(473)

Literature Review

Properties and Applications of "Geon"

B. F. Goodrich Chemical Co.
Cleveland, O.

Describing the company's four *Geon* resins, two polymers and two copolymers of vinyl chloride, discussing the many variations possible, listing properties, and outlining methods for processing, this new 16-page booklet is concisely arranged to provide the reader with information on these products.

Discussion of *Geon* plastics, together with tables on electrical and chemical properties, methods of compounding and effects of various compounding practices, comprise an outstanding section of the booklet, and there is also a section devoted to *Geon* latexes, stable colloidal dispersion of a special type of vinyl chloride resin in water, and information on the newly developed plastics latex.....(474)

Bulletin on Tensile Testing

W. C. Dillon & Co.
Chicago, Ill.

Recently-issued bulletin providing details on testing tensile, compression, transverse and shear, for a wide range of materials and all shapes of specimens.

The bulletin's 8 pages are well illustrated, and, supplementing the information which it contains, free specimen charts compiled by the company's engineers are also available on request...(475)

Molding Materials Booklet

Chemaco Corp.
Berkeley Heights, N. J.

A well-planned and informative booklet presenting details on the plastics molding materials offered by the company, which is a subsidiary of Manufacturers Chemical Corp.

There is a section devoted to each of four *Chemaco* products, namely, cellulose acetate, ethyl cellulose, polystyrene, and vinyl compounds; suggested applications and typical uses for each are listed, and their general properties separately set forth, with a table of comparative general properties of *Chemaco* plastics also included.

Molding methods are discussed, briefly, and miscellaneous helpful data is embodied in the contents of this 20-page booklet .....(476)

Hydraulic Units

John S. Barnes Corp.
Rockford, Ill.

Bulletin *302-U,* giving complete descriptions and specifications of the company's new, completely self-contained L-Type hydraulic units. The text matter is amplified by diagrammatic drawings of the units, and photographic illustration supplies views of a representative Barnes L-Type unit.....(477)

Product Research Data

Evans Chemetics, Inc.
New York, N. Y.

Information on the research facilities of this organization of manufacturing chemists, supplying data on its diversified experience and the services which it is prepared to offer clients, in the creation and manufacture of their products.

Handily compiled in file folder form, this literature, titled "Twentieth Century Alchemists," outlines the history of the Evans research and development laboratories, and supplies details and photographic illustration of a number of its facilities. .....(478)

Injection Molding Data

Arrow Plastics Co.
Passiac, N. J.

New brochure on "Design Hints," prepared by the company as an aid to designers, pointing certain property considerations and various "points to remember" when working with the media of injection molded plastics. Not intended to present complete de-

ails or coverage of the subject, the booklet is presented as offering "some hints and cautions that have proven invaluable in the ast." ..... (479)

Chemical Materials

Hercules Powder Co.
Wilmington, Del.

No. 15 in a series, this issue of "Hercules Chemist" deals with various chemicals supplied by the company for use in numerous industrial and consumer products. Recent chemical developments rom the Hercules laboratories are listed, and briefly described, nd tables, graphs and photographic illustrations accompany the ext matter contained in this 26-page booklet..... (480)

Industrial Finishing Manual

McAleer Mfg. Co.
Rochester, Mich.

Offering helpful suggestions for present-day finishing of all ypes of plastics, metals, and non-metals, a new, illustrated, 24-page industrial finishing reference manual on polishing, buffing, nd de-burring has been issued by the industrial finishing division of this company.

Summarizing and interpreting applications, the booklet tells vhen and where various compositions should be used, and lists numerous finishing materials, including old "stand-bys" of pre-war days as well as new compositions developed for post-war inishing requirements. ..... (481)

Marking Equipment

Acme Marking Equipment Co.
Detroit, Mich.

An attractive catalog, describing more than 150 different products in the marking field, including the company's branded line of *Ram's Head* equipment. Hobs, molds, branders, stamping dies, etc., are described and pictured in this file-size, fully-illustrated catalog which consist of 32 pages and cover.

A carefully-planned classified arrangement provides for quick reference to the information desired, and there is a unique indexing feature at both front and back of the catalog..... (482)

Plastics Defined and Described

Society of the Plastics Industry, Inc.
New York, N. Y.

A timely booklet prepared under the direction of the SPI's Committee on Plastics Education, which briefly outlines the history and development of the industry, its composition, and related details. Plastics as such are defined, and their principal classes, characteristics and uses, the basic methods used in forming them, and their possibilities and potentialities are discussed. Titled "Plastics, The Story of an Industry," its purpose is to supply authentic information and data and to correct misapprehensions concerning plastics.

Employment opportunities and educational facilities for those interested in entering the field are also discussed, and the booklet is carefully indexed and adequately illustrated..... (483)

For Plaster of Paris Induration

Durite Plastics
Philadelphia, Pa.

An 8-page bulletin, *No. 24*, on the subject of *Durite* resins for indurating plaster of Paris, and covering the use of both resorcinol and aminoplast resins for this purpose.

The mixing procedure is described, and there are tables showing various formulas and how they increase physical strength and chemical resistance of the plaster cast.

The bulletin is comprehensively prepared and contains much interesting data on the subject with which it deals..... (484)

Air and Hydraulic Cylinders

Miller Motor Co.
Chicago, Ill.

Bulletins *A-103* and *H-104* provide details concerning the unique mounting features and steel construction which are qualities of this new line of air and hydraulic cylinders. All-steel heads, caps and separate interchangeable steel mountings; flex-

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If you are confused and in doubt as to the right material to use or the right method of molding to follow, why not take it up with *Martindell*? Here is an organization whose head has been in constant contact with the development of plastics since the beginning of the industry. No matter what your problem may be, we can give you sound advice and practical assistance.

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ibility of use; adequate ports insuring rapid, economical operation; identical basic dimensions and mounting dimensions for both cushioned and non-cushioned models, and various other qualifications are offered by their makers as advantages of these products ..... (485)

About Molding and Fabricating

G. Felsenthal & Sons
Chicago, Ill.

Directed to buyers and engineers, this is a booklet which contains interesting information on the products that the company has been making, and is well illustrated with photographs and diagrams of the items discussed in each separate section of the booklet.

There is a chart giving characteristics of some of the most popularly known thermoplastics, as well as other helpful data.

Bearing the title, "From Blueprint to Product in Plastics," the booklet in file-folder form and size, offers ready reference. (486)

Plastics Knobs, Bushings, Parts

Waterbury Companies, Inc.
Waterbury, Conn.

Well-arranged catalog giving illustrations, dimensions, and other pertinent data on the plastics knobs, bushings, and electrical parts produced by the company's Plastics Division.

A special section of the catalog is devoted to each separate classification, and illustrations and diagrams are arranged for quick reference ..... (487)

For Pressure Processing

Hydraulic Press Mfg. Co.
Mt. Gilead, O.

Well-illustrated, 84-page catalog entitled "H-P-M All-Hydraulic Presses for Modern Pressure Processing," recently issued by the company to describe a number of the various types of hydraulic presses to which its production is devoted.

Interesting data on the development of this industrial machinery is a feature of the catalog, and there are photographs and descriptions of many important items of the *H-P-M* line and some of their applications..... (488)

"Anniversary Booklet"

Emeloid Co., Inc.
Arlington, N. J.

Titled "Twenty-Five Years of Progress in Plastics," this booklet relates briefly the story of the company's development since its beginning a quarter-century ago, and outlines the various services which it now offers, including injection molding, laminating, printing, stamping; cutting, machining, buffing, embossing, etc.

A number of articles fabricated and molded by the company are illustrated and details concerning its facilities are listed ..... (489)

Mold Release Booklet

Dow Corning Corp.
Midland, Mich.

Describing the use of *DC Mold Release Fluid* and *DC 7 Compound*, two Silicone products which are used to secure release of rubber or plastics materials fabricated by injection or compression molding, pressure laminating, and casting.

The properties of these products are set forth in the booklet, which provides details as to each use of the preparations.. (490)

Laminated Plastics Development

Continental Diamond Fibre Co.
Newark, Del.

Bulletin *PFD-33* describing the company's "Post Forming" *Dilecto* laminated phenolic plastics sheets, which can be readily formed to a variety of shapes in simple, inexpensive cold molds. The procedure is explained, and characteristics and properties of the material listed.

Photographic illustrations, tables and graphs supplement the text and specifications, and sizes in which the material is available, are indicated..... (491)

CIBANITE

A

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PROBLEMS in *plastics*

Problems and questions may be submitted to this department for answering by the technical editors or specialists in the industry.

Please furnish me the names of manufacturers of clear plastics tubing for use in siphon bottles. J.J.N., San Francisco, Calif.

The following companies should be able to supply the desired product: Acadia Products Company, 4115 W. Ogden Avenue, Chicago, Ill., and the Hodgman Rubber Company, 173 W. Madison Street, Chicago, Ill. Further information and names of other manufacturers may be obtained from Tennessee Eastman, Kingsport, Tenn., and the Dow Chemical Company, Midland, Mich., whose "Tenite II" and "Saran" respectively are used in the manufacture of transparent tubing. For a detailed discussion of these two materials as tubing, see the article "Indestructible Piping" in the August, 1945, **plastics.**

* * *

We should like to have information on the possible development of plastics bottles for a product such as beer.
H.J., Milwaukee, Wis.

Although, so far as we know, there has been no development of plastics beer bottles, transparent plastics tubing (see above question and answer) has been used successfully in beer dispensing apparatus. Besides the two materials mentioned, polystyrene should be suitable for beer bottles because of its excellent chemical resistance. A major deterrent to the development, at present at any rate, appears to be the cost of plastics as compared with that of glass.

* * *

Please recommend a good material for the following use: squares or discs about seven millimeters in diameter, thickness one and one half millimeters plus or minus three-hundredth millimeters, which must stand a process temperature of 300° F, which will not swell in cold weather, and which is reasonably hard. The pieces can be cut or stamped from sheets or molded, as edge finish is immaterial.

We believe the best material for your purpose is laminated sheet stock. A suggested product is a "Fiberglas" based melamine-formaldehyde laminate. It will stand over 300° F, possesses excellent dimensional stability, and has a Rockwell hardness of M90 to M110. Perhaps also a cellulose or chopped fiber-filled melamine or phenolic molding powder molded into squares or discs would have the requisite properties. If so, it would be less expensive than the laminated material.

* * *

We are conducting experiments on the preservation of insects in plastics blocks. We have in mind spraying the insect first with a plastics solution forming a protective coating, then suspending the coated insect in a liquid monomer which may be polymerized at a low temperature. Do you have any suggestions to offer? A.F., New York, N. Y.

We suggest that you write the B. F. Goodrich Chemical Company, 324 Rose Building, Cleveland 15, Ohio, concerning the suitability for your use of its new casting resin "Kriston," the description of which in the December **plastics** *indicates that it may be just what you are looking for. Certain types of insects have been preserved in "Plexiglas" blocks, but we are not at liberty to tell you more about the process at present.*

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STAFF OF 181 TWELFTH YEAR

INDUSTRY HIGHLIGHTS

A new plant at Belvidere, N. J., has been acquired by Celanese Corp. of America. Comprising 800 acres and several buildings, including a main building of 100,000 sq ft, the new plant is to be used for the production of chemicals, plastics, and related products. According to present plans, the new Celanese plastics, *Forticel,* is among those which are to be produced at the Belvidere location.

Products manufactured at the new plant, it is announced, will be marketed through the company's wholly-owned subsidiary, Celanese Plastics Corp.

It is further announced that operations at the company's plastics plant at Newark, N. J., will continue, and that an expansion of facilities amounting to 25% over the next two years is in progress.

A nylon base laminate which is fungus-resistant and combines in marked degree the high electrical insulating properties of paper base laminates and the mechanical properties of fabric base laminates has been developed jointly by Mecoboard, Inc., and Continental-Diamond Fibre Co. The new product, hitherto restricted to high priority military equipment, where it has been widely used for electrical insulating parts in radar and other high fidelity communications equipment, is now available for general civilian use, in sheets, rods and tubes.

Nylon base laminates are made with both melamine and phenolic resins.

Extension of the area of the Washington sales office of The Dow Chemical Co. to include Virginia, North and South Carolina, Georgia and Florida has been announced by Leland I. Doan, vice president and director of sales, as having become effective on January 1. The Washington staff of the company is being augmented to handle the additional activity for this southeastern territory which was formerly covered by Dow's New York office.

A new-type synthetic resin designed to improve the appearance and durability of plaster casts, has been developed by Duorite Plastic Industries, Culver City, Calif.

Called *Plastiglaze,* this new product is described as an air-setting material produced by combining various thermoplastic and thermosetting resins in the presence of any one of several solvents. Although normally transparent, it can be colored with various common pigments. Complete or partial impregnation of a plaster casting with this material may be achieved by means of immersion in the resin, or a surface coating, providing a glossy, enamel-like finish, can be applied by means of spray, brush, or dipping.

Plaster casts impregnated with *Plastiglaze* are said to be strengthened to a point of high breakage-resistance, and to withstand deterioration when immersed in solutions of water and acid for days. It has also been used to strengthen such materials as wood, *Firtex,* and cardboard.

Formation of a partnership with Philip D. Wilkinson has been announced by Frederick S. Bacon, chemical research consultant, Watertown, Mass. The new firm, which will operate under the name of Frederick S. Bacon Laboratories, is to continue the chemical research and consultation business established in 1939 at the present location, 192 Pleasant St.

A recently announced merger, effective January 1, is that of Globe Tool & Molded Products Co. and The Imperial Die Casting Co., which will operate as Globe Imperial Corp. It is further announced that there is to be no change in management or personnel.

A new department has been established by The M. A. Hanna Co., Cleveland, for the purpose of conducting technological research in coal and other industrial lines in which the company is interested. The department is intended to provide research service for Hanna customers, and to supplement the work of existing coal research organizations, and will be concerned with the development and advancement of the use of coal-derived hydrocarbons by the plastics, chemical, and other industries.

The recent appointment of Barwood Co., Philadelphia, as sales representative for the Size Control Co.'s line of precision reversible plug gages and the Walsh Press & Die Co.'s line of punch presses from 6 to 80 tons, has been announced. Both companies are divisions of American Machine & Gage Co., Chicago.

Also announced is the establishment of a factory branch of Size Control Co. at Greenwich, Conn., under the management of Theodore Breunich.

Construction on an addition to the company's Toledo, O., plant is scheduled to start this spring, according to announcement by E. I. du Pont de Nemours & Co.

This new production unit of the electro chemicals department has been planned for the purpose of providing midwest users of Du Pont formaldehyde with a source of supply closer than the company's Perth Amboy, N. J. plant.

Now in production by the Daystrom Corp., Olean, N. Y., an associate of the American Type Founders, are plastics panels for use in various architectural applications, including furniture, restaurant fixtures, etc.

Many thin sheets of plastics-impregnated material, fused together under extreme heat and pressure, are used in the manufacture of the panels, which are said to be chip-proof, stain-proof, and heat resistant, with a smooth and non-porous surface which is easily cleanable with a damp cloth.

According to M. L. Brown, vice president of the Daystrom Co., production of such sheets was a small part of the company's program before the war, but a more durable sheet, made possible through newly-developed techniques, and new equipment acquired by the company, warrant its branching out in a separate division.

A new cold room for the testing of various compounds and products of plastics, rubber and other materials has been installed by B. F. Goodrich Co. at its plant in Akron. Temperatures in this room can be varied from + 50° to — 90° F.

The room has five working units, each 6 ft sq, with each unit working separately, and each large enough to permit tests of equipment under temperatures found in the colder parts of the United States and Canada, as well as those encountered in high altitude flying.

Designed to fill the need for a one-coat material with top resistance to food acids and fats, and to provide stability under high and repeated baking temperatures, a new flexible coating, called *Rolox Vinyl White Coating Enamel,* has been developed by Roxalin Flexible Finishes, Inc., Elizabeth, N. J.

Mentioned as an outstanding characteristic of this new product is its 52% solids, and qualities listed include excellent adhesion even when it is applied directly to unsized black plate, electrolytic or hot dip tin; resistance to sterilization and food processing; stabilization in the process of manufacture and will not disintegrate in contact with metals at elevated temperature; completely odorless and tasteless, and extremely flexible.

Formation of the St. Regis Sales Corp. as a wholly-owned subsidiary of the St. Regis Paper Co. to handle sales of all products manufactured by all divisions of the company and its United States subsidiaries, including Taggart Corp. and Watab Paper Co., has been announced by Roy K. Ferguson, president of St. Regis Paper Co. as well as of the new sales subsidiary.

Personnel and operating method of the parent company remains unchanged, according to Mr. Ferguson, who stated that the step had been taken as a means of enabling the company to increase its sales service to customers.

Extensive plans for expansion in plastics production facilities of the Dow Chemical Co., Midland, Mich., were recently outlined by Dr. Willard H. Dow, president of the company. A considerable amount of new construction is already in progress, and the balance of the projected expansion is schduled for continuing extension of facilities of the period of the next five years.

Dr. Dow expressed the opinion that the first concern of the industry should be volume production to meet demand, at the same time widening the scope of plastics materials as cost economies are realized, and helping to maintain employment in this country at a high level.

Adoption of the name of *Taypit* for its retail consumer line of self-sealing transparent, colored, and decorative tapes has been announced by International Plastic Corp., Morristown, N.J. The announcement adds that the company's line of tapes for industrial and commercial applications will continue to be sold under the name of *Filmonize*.

A new type of plastics compound, described as having many possibilities of use, has been announced by the Plastics Division of General Electric Co., Pittsfield, Mass.

This new material, developed to seal the ends of metal tubing to keep the interior free of dust and moisture while being shipped, stored, or handled, forms caps and sleeves which can be produced to specified diameters and thicknesses, and shipped dry. They are expanded, previous to use, by soaking in *G-E Dilator Solution No. 12501*, and expansion can be as great as 50% of their normal size; placed in position and allowed to dry, they shrink to less than their normal size, forming a tight fit and are said to be completely water-resistant and air-resistant.

Available in a number of colors, these caps and sleeves have already found many new uses, among which are those of lead markers on wires and cables, as insulation covering for bus bars, selsyn motors and wire cleats, and on air conditioning and refrigeration equipment.

An article dealing in detail with the subject of plastics caps and closures appeared under the title "Durable Industrial Closures," in ***plastics,*** July 1945.

In a news item in "Industry Highlights," November 1945 ***plastics,*** mention was made that the new laminating plant of General Electric Co., which is located at Coshocton, O., would cover 25,000 sq ft. This was a typographical error, 285,000 sq ft being the correct figure.

Hercules Powder Co. reports that the year 1945 was marked by a peak production at almost all of its plants, and the launching of a comprehensive expansion covering all operating departments. Demand for the company's products, it is added, continued at high levels after the end of the war, necessitating capacity production.

Construction of new plants and facilities provided in Hercules' expansion program which, it is expected, will be completed within three years, will enable the company to maintain employment at the levels reached in its own business at the war's end.

Ground was broken on January 3 for a new research center to be erected on a 260-acre tract midway between Akron and Cleveland, by B. F. Goodrich Co. The day also marked the 75th anniversary of the company's founding, which was observed with appropriate ceremonies.

Plans for the research center at present call for five separate buildings of most modern construction, and at the outset of operations the staff will consist of between 220 and 250 people, according to Dr. Howard E. Fritz, the company's director of research, who emphasized the fact that plans allow for almost unlimited additions and expansions, either by enlargement of the buildings already scheduled or by adding of more structures.

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PEOPLE

The retirement of **George S. Thacker** from the position of general manager of traffic for Continental Can Co. has been announced by Sherlock McKewen, secretary-treasurer of the company.

* * *

Richard W. Girvin has become retail sales manager of the cellulosic department of International Plastic Corp., Morristown, N. J.

* * *

Two new executives have been added to the staff of Carbide Die & Mold Co., Pittsburgh. They are **William C. Uecker,** treasurer and sales manager; and **Ernest G. Merlin,** secretary and sales representative; both new appointees have had extensive experience in the field.

* * *

Stephen D. Hiltebrant has been made sales manager of the molded plastics division of General Industries Co., Elyria, O. He was formerly associated for 8½ yrs with the Detroit office of Bakelite Corp. as technical representative, and during 1945 was president of the Detroit section of SPE.

W. C. Uecker

E. G. Merlin

S. D. Hiltebrant

Appointment of **W. F. Greiner** as manager of the Decorative *Micarta* department of the United States Plywood Corporation was recently announced.

* * *

T. J. Holmes has been named sales manager for the New England district of the chemical department of General Electric Co., and will be temporarily located at Lynn, Mass., with permanent headquarters to be established later in Boston.

* * *

Appointment of **M. T. Callahan,** formerly with the plastics division, E. I. du Pont de Nemours & Co., as assistant manager of Columbia Protektosite Co., Inc., has been announced by the latter company.

* * *

G. V. Woody has been named manager of the basic industries department of Allis-Chalmers, Milwaukee, succeeding **R. C. Newhouse,** who has retired after having been associated with the company since 1905; Mr. Newhouse, who is noted as an engineer, inventor and designer of some of the world's largest cement and mining machinery, is being retained by Allis-Chalmers as a consulting engineer.

J. L. Singleton has recently been appointed manager for the 60 district offices of the company's general machinery division's sales department.

* * *

Wayne Brinkerhoff has been named advertising manager of B. F. Goodrich Chemical Co., Cleveland. He was formerly manager of technical data service for the company.

* * *

Julius Loeb, chairman of the board of Universal Plastics Corp., and retired vice president and treasurer of American Metal Co., Ltd., died at his home in New York City in January.

* * *

Dimitri G. Soussloff has been made a partner and technical director of Neo Plastics Products Corp., N. Y., custom molder, and manufacturer of handbags, compacts, and novelties of plas-

ics. He was formerly associated with Celanese Plastics Corp., where he was engineer in charge of engineering development and research.

* * *

N. P. Malin, who was, previously, export manager of Marshall Dill, San Francisco, has been named manager of the Far Eastern sales department of Heyden Chemical Corp.

* * *

Robert G. Allen has recently been appointed general sales manager of The Baldwin Locomotive Works; prior to this appointment he held the office of general manager of the company's Baldwin Southwark Division.

* * *

Mayfair Molded Products Co., Chicago, has announced the appointment of **Luther J. Evans** as president of the company. He was formerly Chicago sales representative of the plastics division of Continental Can Co.

* * *

Returning from the Army to their former positions as salesmen for Ciba Co., Inc., are **Maj. Clement O. Stevenson** and **S/Sgt. Robert L. Horney,** both of whom are connected with the southern branch office of the company, Charlotte, N. C.; and **Lt. Chester M. Kopatch,** of the New England branch office, Boston.

* * *

E. R. Nary has been appointed assistant to Walter Evans, vice president, Westinghouse Electric Corp., and in his new capacity is to have broad responsibilities for the company's industrial electronics and X-ray divisions at Baltimore, and the home radio division at Sunbury, Pa.

* * *

John V. Muddle has recently been appointed New England representative of Precision Paper Tube Co., Chicago, and will have his offices in Ashland, Mass.

* * *

Product designer Peter Muller-Munk, Pittsburgh, has announced that **Capt. Raymond A. Smith** has joined the Muller-Munk organization as chief designer.

* * *

Edward A. Reineck has joined the technical sales staff of the chemicals department of The Quaker Oats Co., Chicago, where he will assist in the development of new applications for *Furfural* and its derivatives in the resins and plastics industry.

* * *

Election of **Allan Brown** as vice president in charge of advertising and public relations, and **George C. Miller** as vice president and general sales manager of the thermoplastic department, has been announced by J. W. McLaughlin, president of the Bakelite Corp.

E. A. Reineck
Bachrach Photo

A. Brown

J. Loebenstein

F. G. Harlow has been named Washington and Government representative of Radio Receptor Co., Inc., New York City, and **Julian Loebenstein** has been made sales manager of the company's new selenium rectifier division.

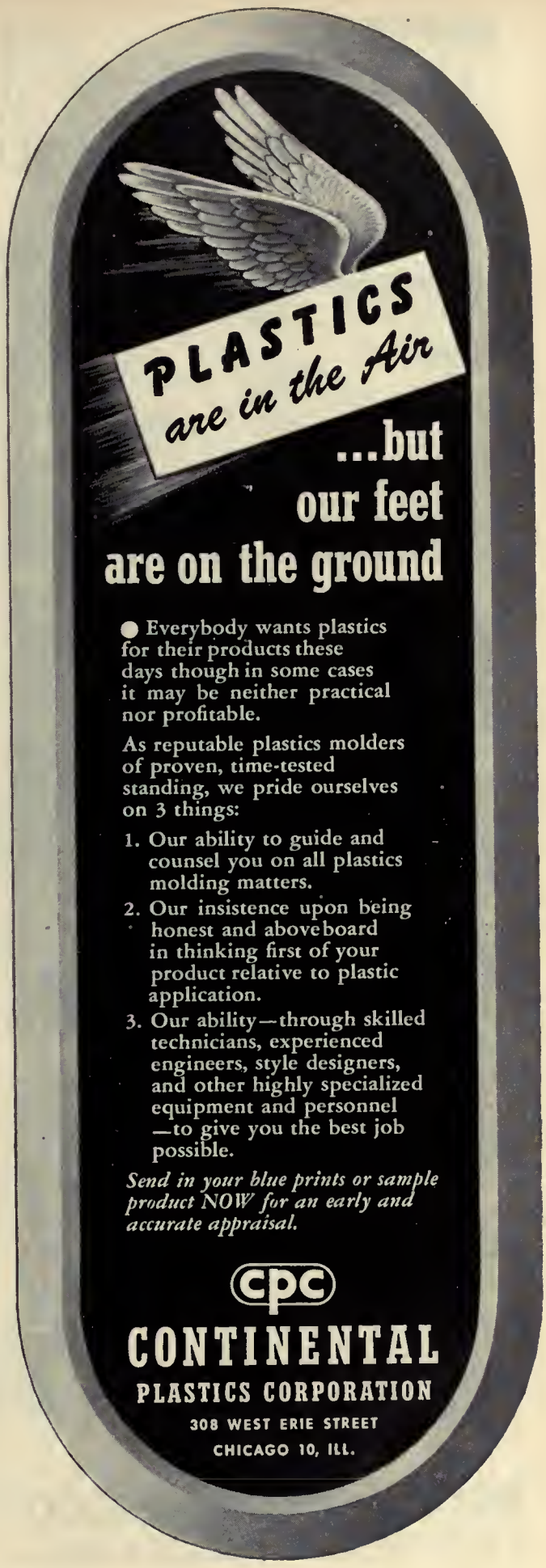
* * *

Victor F. Mutch has announced his resignation as president of the Cordo Chemical Corp., Norwalk, Conn., effective December 31, 1945, stating that it is his intention to continue in the plastics business, specializing in the manufacture of plastics-based coatings.

* * *

Jules E. Timer, for more than 10 yrs with the Sherman Paper Products Corp., Newton Upper Falls, Mass., has been made director of trade relations of International Plastic Corp.

* * *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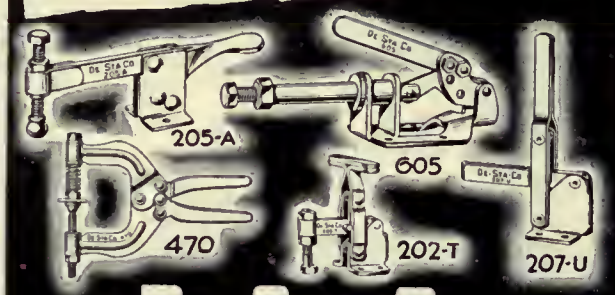
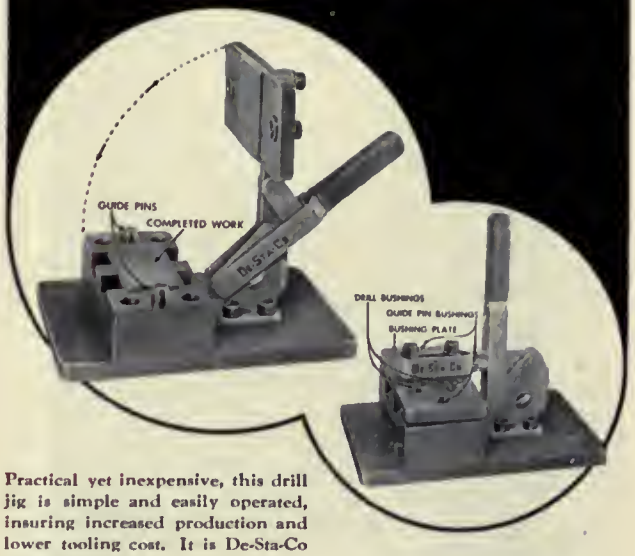


DE-STA-CO
TOGGLE CLAMPS



Practical yet inexpensive, this drill jig is simple and easily operated, insuring increased production and lower tooling cost. It is De-Sta-Co Clamp No. 207-U.

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Positive pressure is gently and uniformly applied —automatically maintained—instantly released.

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New De-Sta-Co Catalog No. 45 describes and illustrates De-Sta-Co Clamps—suggests time saving applications—Send for copy.

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association activities

PMMA Elects Officers

W. Stuart Landes, vice president of Celanese Corp. of America, and John R. Hoover, vice president of B. F. Goodrich Chemical Co., were re-elected president and vice president, respectively, of the Plastics Materials Manufacturers Association, Inc., at its annual meeting in New York on January 10. Frank H. Carman was re-elected general manager, and John E. Walker, secretary-treasurer, with headquarters in Washington, where they both reside.

A seven-man board of directors was also named by the association, including, in addition to Mr. Landes and Mr. Hoover,

W. S. Landes

J. R. Hoover

two directors held over from the 1945 board, namely, James L. Rodgers, Jr., vice-president of Libbey-Owens-Ford Glass Co., and Dr. D. S. Frederick, vice president of Rohm & Haas Co. New members of the board are Harry Krehbiel, president of Catalin Corp.; M. G. Milliken, vice president of Hercules Powder Co.; and Felix N. Williams, vice president of Monsanto Chemical Co.

Arnold E. Pitcher, general manager of the plastics department, E. I. du Pont de Nemours & Co., and past president of PMMA, will serve in an advisory capacity to the board of directors, in accordance with the by-laws.

The resins and adhesives division of PMMA, at a meeting held previously, elected Louis Klein, vice president of the Resinous Products & Chemical Co., as its chairman.

Two-Day Meeting for Pacific Coast SPI

The Spring meeting of the Pacific Coast section of the Society of the Plastics Industry is scheduled for Los Angeles, March 26 and 27. An expansive program has been planned by leaders of that Section for the two-day session, which will be featured by a series of technical panels dealing with topics of considerable interest to the industry.

Packaging Exposition in April

A four-day show is planned for the Packaging Exposition of 1946, which is scheduled to open on April 2 at the Public Auditorium, Atlantic City, N. J. Sponsored by the American Management Association this fifteenth annual show has been designed to surpass its fourteen yearly predecessors in many respects, including size and comprehensiveness of cope, according to advance announcements. The AMA Packaging Conference is to run concurrently with the exposition, in another section of the building.

New and improved methods, materials, etc., in the field of packaging, packing and shipping, for various industries, and much else of interest is promised for those attending the exposition.

Informal Discussion at Newark SPE Meeting

At a dinner meeting of the Newark chapter of the Society of Plastics Engineers, held in December at the Newark Athletic Club, an innovation was introduced in that the featured speaker,

ward Keusch, of Boonton Molding Co., did not deliver a set ech on "positive and transfer molds," which was the topic signed him, but invited audience participation at any point in talk. The result was something of an informal symposium, th which the audience was well pleased, and the chapter accdingly plans to continue this type of feature, as well as the stomary formal talks.

STE Appoints New Executive Secretary

Recently announced by the board of directors of the American ciety of Tool Engineers was the appointment of Harry E. nrad as the organization's executive secretary.

etroit Rubber & Plastics Group

Meeting at the Detroit-Leland Hotel, on December 14, mems of the Detroit Rubber & Plastics Group held a Christmas rty and dinner meeting. Speaker of the evening was Dr. ebster N. Jones, director of the college of Engineering, Cargie Institute of Technology, whose talk was on the subject of Engineering Tomorrow."

Officers for 1946 were elected by the Group, as follows: J. R. nroyer, R. T. Vanderbilt Co., chairman; Paul Wilson, Ford otor Co., and Gordon Saunders, Dodge Main Plant, 1st and d vice-chairmen, respectively; E. J. Kvet, Baldwin Rubber o., secretary-treasurer; C. W. Selheimer, Wayne University, ssistant secretary-treasurer.

redictions of Development in Plastics

Its last meeting for the year 1945 was held by the Plastics lub of the U. S. on Dec. 11 at the Hotel Pennsylvania, N. Y. William T. Cruse, executive vice president of the SPI, was peaker of the evening, and delivered an interesting talk on wartime achievements in plastics, and the current materials supply tuation; he also made some forecasts concerning the future of he plastics industry. Among these were his predictions that, in he main, the same basic types of plastics will continue in use, though the number of their applications will probably double in the next five or ten years; that there will be an increased use of polyethylene and of blow-molding; that molding of thermosetting compounds will be increased in conjunction with the development of high-frequency heating, and that automatic fabricating machinery will be developed to a much greater extent.

Plans for ASTM Meetings

The forty-ninth annual meeting of the American Society for Testing Materials, according to recent confirmation by the organization's executive committee, is to be held in Buffalo, June 24 to 28, and the seventh exhibit of testing apparatus and related equipment is to be held in conjunction with the meeting.

The 1946 Spring meeting of the Society has been scheduled for Pittsburgh, during the week of February 25 to March 1. This has also been designated as ASTM Committee Week.

"Production for Profit" Show

Sponsored by the Chicago Technical Societies Council, and to be held in conjunction with that organization's fourth annual conference, a production show, featuring "production for profit," is planned for March 20, 21 and 22 at the Stevens Hotel. Broad scope and emphasis are to be placed on new efficiencies in factory production, and new materials, new tools, new instruments are to be on display, it is announced, stressing the change from wartime to peacetime production.

ERRATA

Publication of photographs depicting the use of *Compar* as a protective material, in connection with the article, "How To Guard Against Dermatitis," by Dr. Louis Schwartz (***plastics,*** November 1945) was not intended to indicate or to convey the impression that the product is endorsed by Dr. Schwartz, whose article dealt with the subject matter and does not constitute his endorsement of any particular or specified product or products.

Cumberland Plastics Granulating Machines

Plastics granulating machines for every capacity requirement

Four Cumberland machines, built specifically for plastics, give a wide range of capacities. The No. 0 model is frequently used one per injection molding machine, so that the molding operator disposes of the sprues and runners as made. The No. ½ machine, illustrated here, has capacity for granulating the scrap from two or three molding machines. Larger sizes are the No. 1½ and the 18", which afford more capacity and grind material of large cross section.

Cumberland machines have the following features:

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Casting Phenolics

(*Continued from page* 31)

economical to fabricate duplicate phenolic molds to avoid the higher costs of steel dies. However, such mass production was not undertaken on an extensive scale.

The casting of prototypes and parts in phenolic molds is simple. Phenolic resin, catalyzed to accelerate the cure, is poured at room temperature. Molds are maintained at 200° F.

With half of the casts, all of the resin is hand-poured through a gate of ¼ to ½ in. diameter. In casts with widely extended mold cavities, the lower section of the die is filled while the upper segment is displaced. The upper section then is placed in position, and the filling is completed through the pouring gate.

In casting miniatures of a Lockheed P-80 seven inches between its wingtips, the latter pouring method was employed. When the mold was filled, a rubber pad was placed upon the pouring gate. The mold was moved to a centrifuge in an oven at 200° F. Pressure of 250 lb. was exerted by compressed air to maintain stability between the two mold sections, and the centrifuge was spun for 10 sec to flow the resin away from the pouring gate and into the remote parts of the form.

A static period of 30 sec followed to permit air bubbles to escape through the pouring gate, from which the rubber pad had been removed. After this brief interval of inertia, the pad was replaced, air pressure again was exerted, and the spinning was resumed for one minute, by which time the cure had taken place.

Break-away of the mold was effected by hand. The hardened cast was ejected from the die by a knock-out pin inserted through the pouring gate. The die then was air-blown, wiped free of moisture, and reheated to the proper temperature for the next operation.

Little post-casting treatment is needed for phenol-formaldehyde prototypes, parts, or miniatures formed in phenolic molds. Excess is broken away by hand. Rough edges left by flash or "fins" are smoothed on a buffer or with sandpaper. Stems caused by excess in the pouring gate are sawed off. All surfaces formed by direct contact with the mold are notable for their precision and high gloss.

The mold for the plane miniature was built for $70. Price of a steel die was estimated at $1500. Eight hundred miniatures, ordered for distribution as Lockheed souvenirs, were delivered at 60¢ each, the buffing and sandpapering to be performed by the buyer.

So rudimentary are the operations in phenolic casting that once the mold is constructed, the technical requirements may be grasped quickly by unskilled workers. In 12 min from start of the pouring until removal of the cast, one green hand produced the jet plane model. After three days of practice, it took him only 4 min. Obviously, the quick setting of phenol-formaldehyde, accelerated by the catalyst under heat treatment, is an important factor.

Sometimes in filling multiple cavity molds, the injection method is used. As many as 22 small items, such as knobs, police whistles, or handles, have been cast by this process in a single operation.

Phenol-formaldehyde, plus other ingredients, is utilized by Rezolin in molds and castings because of its long-wear and dimensional stability. Various fillers increase the stability, insure against shrinkage, and provide a molded part true to scale. A catalyst, which performs under heat treat-

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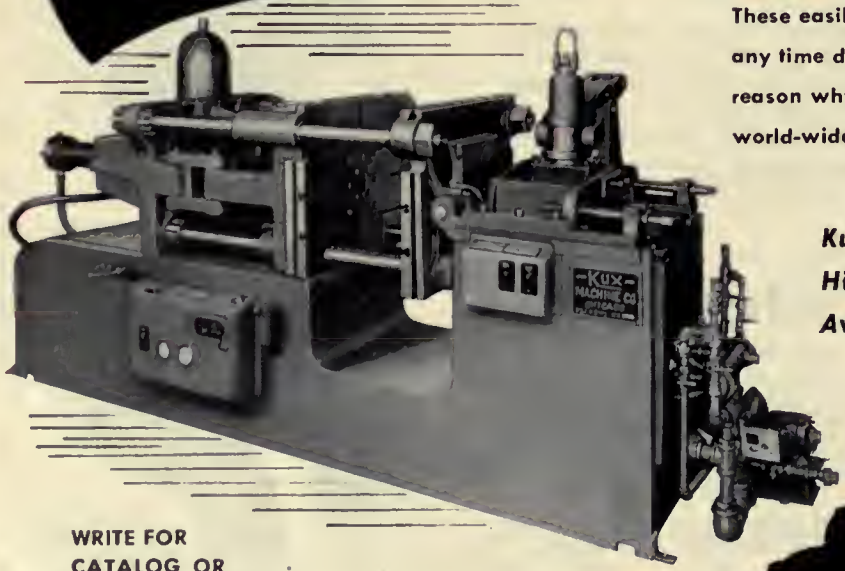

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nt, helps minimize the setting time. Machining virtu- y is eliminated.

But the great factor is low cost, as attested to by the fact at 94¼% was sliced from the overhead in fabricating ven phenolic molds and that, in a series of cases, $1155 in enolics did what was estimated to cost $20,100 in metal.

Casting of phenolic molds opens the way for many small t important operations, which their cost in metal dies uld render prohibitive. Likewise, phenolics are making od in larger operations, such as fabrication of jigs, nest ocks, and stretch-form dies.

New problems pop up daily in this intriguing business. he demand for unusual casting performances seems limit- s. Each problem calls for a specialized approach, backed engineering skill, an understanding of the capabilities plastics rightly applied, and the confidence that plastics, hen properly handled, will do the unusual job. END

Cost Comparison: Phenolic and Steel Molds*

m or Part	Estimated Cost in Steel	Actual Cost in Phenolics
ckheed P-80 jet propulsion plane miniature	$1,500	$ 70
tentiometer coil frame originol prototype	1,850	80
developed prototype	1,850	65
dio cabinet originol prototype	3,000	300
developed prototype	3,000	220
ckheed P-80 gun handle prototype, 8-port assembly	4,200	360
othes pins, Cavity Mold, 8 half-ports cost in one operation	4,700	60
Total	$20,100	$1155

* All figures furnished by Rezolin.

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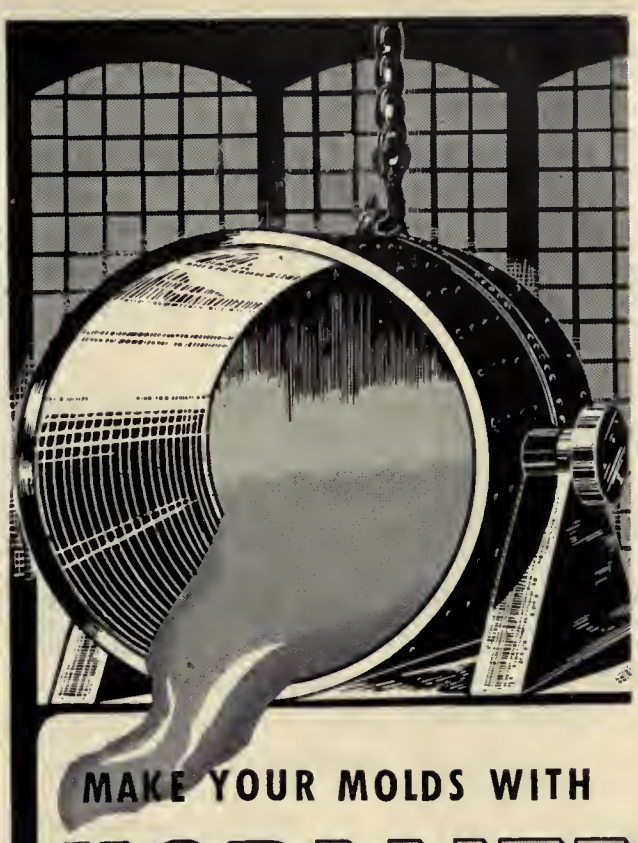

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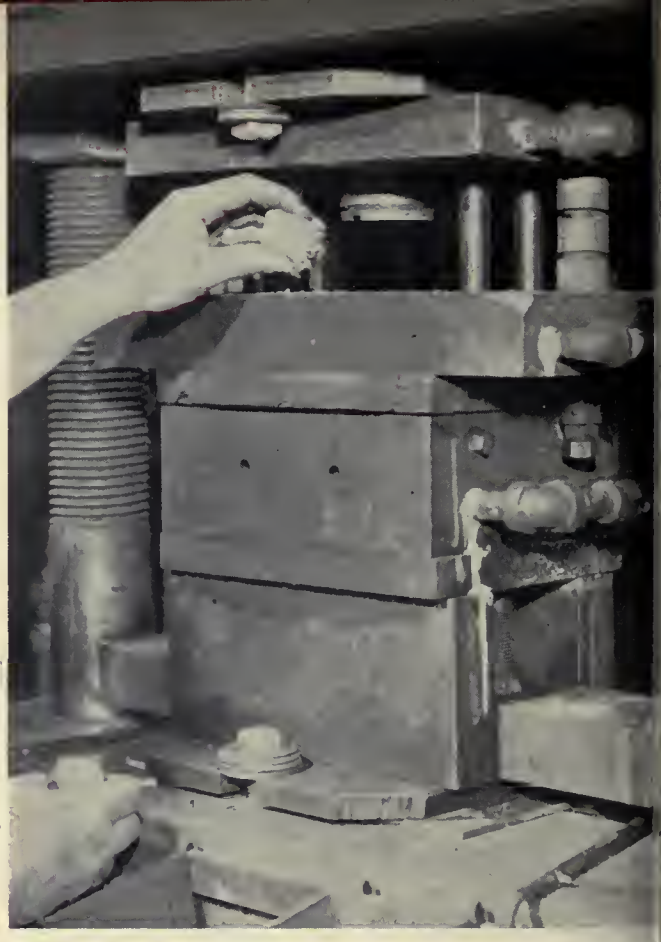
Pot Design for Transfer Molds

By T. N. Willcox
Plastics Division, General Electric Co.

Efficient design and use of the plasticizing chamber is required to obtain full advantages from the process of transfer molding



Cylindrical pot plunger with dove-tail to pick up cull and piston ring groove to prevent flashback of compound

BECAUSE transfer molding imparts to the molding of thermosetting plastics merits more or less comparable to those of the injection molding of thermoplastics, it has become a well-established method for plasticizing molding materials and forcing them through a small orifice into the mold cavity. One of the important considerations in this method of molding is efficient design and use of the pot or plasticizing chamber, a judicious balance of the following items being required to give an economically short transfer time: type of compound, pressure on compound, type of pot, pot dimensions, clamping tonnage at parting line of mold, weight of plastics compound, preheat temperature, pot temperature, and orifice position and size.

Floating pot in discharge position and rectangular plunger

Choice of compound is the first factor in pot design. Experience shows that different plastics compounds require different transfer pressures. Typical ranges for phenolic resin compounds are: wood-flour filled, 6,000-8,000 psi; cotton-flock filled, 6,000-10,000 psi; and rag-filled, 8,000-12,000 psi.

Three types of transfer pots are in general use. The most common is the closed bottom pot supported in a floating shoe. Transfer pressure is supplied by the same force that clamps the mold cavities. The other two designs use separate transfer power, and the pots, supported in a stationary retainer, may be closed or open bottom.

Considering, first, the floating pot, it is advisable to assume that full hydraulic pressure is transferred from the pot into the cavities. In order not to jack open the cavities by hydraulic action, the area of the bottom of the pot should be 10 to 25% larger than the parting line area of the cavities. All elements for a *preliminary* pot design are now present: the molded part determines parting line area; the parting line area gives pot area; and selection of compound gives tons per square inch transfer pressure, which, multiplied by pot area, gives the size press required to mold the part.

Engineers who follow this rule of thumb design will be embarrassed on occasion to find transfer time so long that extremely high tonnages are necessary to transfer compound ahead of pre-curing. This condition is particularly true for parts of relatively thick cross-section and deep recesses. A certain minimum rate of heat transfer from the pot walls is required to suitably plasticize and permit flow of a given charge of compound. For normal mold temperature and slight preheat, good design practice uses a minimum of about 6 sq in of pot heating area per ounce of compressed phenolic-resin cellulose-filled compound. As preheat is raised, the heating area can be reduced, until, with

ull dielectric preheat, transfer time is independent of heating area.

Stationary pots can be made small in diameter without anger of flashing the cavities. Waste compound in the ull is measurably reduced. Mold operation is speeded because of more rapid engagement of the transfer plunger nto the pot. Offsetting features are more complex press lumbing, reduced compound loading space, and higher ress investment. The open bottom pot offers a further aving in compound by eliminating the sprue used in a losed bottom pot. Its drawback is the extra clamping ressure required to overcome the subtractive effort of the ransfer plunger.

Determining Dimensions

Dimensions for stationary pots must take into account eating area, weight of charge, type of compound, ease of oading, temperature of preheat, and available tons from he transfer cylinder. As described for the floating type ot, good design requires about 6 sq in of heating area per unce of compressed charge. A relatively small diameter with deep loading space is to be avoided. When the compressed height exceeds the minimum width of the pot by a ratio of 3, internal friction and pre-curing phenomena rapidly raise the required transfer pressure. Dielectric preheat can increase the usable ratio well over 3. Even so, difficulty can be expected when loading sizeable charges into small-mouth pots. Suitable transfer time for all types of transfer pots usually ranges between 5 and 45 sec. Some very soft or highly preheated materials will transfer in less than 5 sec, but these may show evidence of trapped gas and burned marks. Successful transfer times well over 45 sec have been observed with slow curing compounds or when molds are run at reduced temperatures.

Checking Transfer Time

To check transfer time on any given design of pot, the following formula has been successfully used on phenolic resin compounds. It is reasonably accurate for limited ranges of variables.

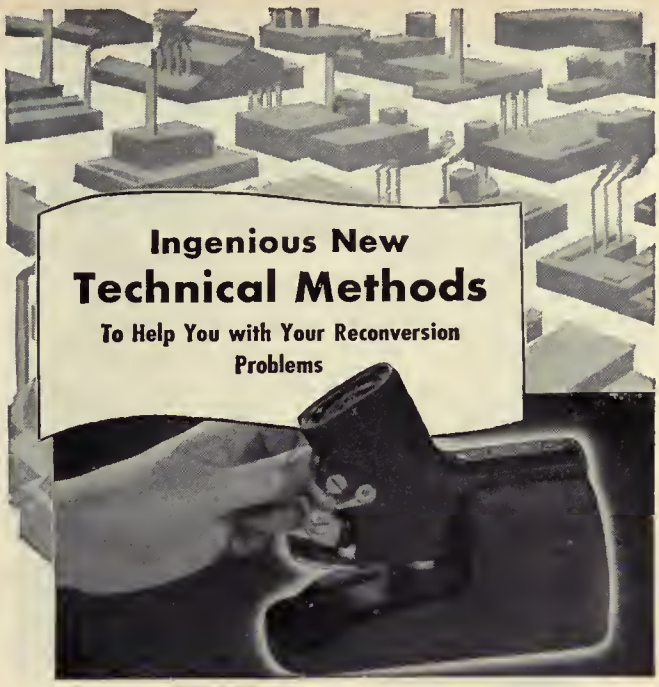
$$T = K \frac{10{,}000 \left\{\frac{400\text{-}Tp}{10}\right\}^{2.5}}{\left\{\frac{\text{sq in.}}{\text{oz}}\right\}^{2} (1000\,A_0)^{0.18} \left\{\frac{Tm}{10}\right\}^{25} (Pc)\,0.6} \text{ minutes}$$

Where:

Factor	Range Min.	Max.
T = transfer time (min)		
K = compound constant	1.0	
Tp = preheat temperature (°F)	80	200
Sq. in. = pot heating area (sq. in.)	4	200
Ao = orifice area (sq. in)	0.010	0.200
TM = pot temperature (°F)	310	360
Pc = transfer pressure (psi)	6,000	12,000
Oz = weight of compound in pot (oz)	1	16

Pot heating area includes all surfaces transferring heat into the compressed charge of compound. Orifice area is measured at the minimum restriction in the passage from pot to cavity. The above equation does not necessarily hold when the compressed height of compound is greater than the minimum width of the pot.

Choice of round, rectangular, trapezoidal, or other shape of pot is controlled by the location of sprue holes for shortest entry into mold cavity and, also, by the additional cost of odd shapes over a simple round pot. Some benefit is gained in transfer time by using shapes other than round because of additional side wall heating area. Pots should be designed so that shrinkage of the cured cull will not pre-



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vent its easy removal. An example of a poor design from this standpoint is a ring-shaped pot.

Suitable clearance between pot and plunger is nominally 0.0005″ per side. To prevent binding, it is good practice to use the same temperatures on pot and plunger.

An excellent method exists for preventing flashback of compound between plunger and cavity wall. One or two shallow grooves should be cut around the circumference of the plunger just above the pressure face. These grooves fill with compound when the mold is first used. The resulting piston ring prevents further leakage of compound.

Removal of the cull is no problem with the "open" bottom pot. The pot plunger is simply made long enough to push out the cull when the mold opens. The cull is best removed from the closed bottom pot by providing a tapered dovetail recess in the face of the plunger into which the compound molds and is cured. The cull with the molded dovetail is mechanically removed from the face of the plunger after the plunger is withdrawn at the end of the molding cycle.

The future of transfer molding seems closely tied to dielectric preheating. Pot design will be simplified because heat transfer from the pot walls will no longer be the controlling factor in transfer time. Sufficient pressure quickly applied to a well-preheated compound gives transfer times limited only by the closing speed of the press. END

Know Your Butyrates

(*Continued from page 37*)

shower clogs, the Army bugle, and a judging model of the perfect Guernsey cow.

The compression method permits the molding of pieces too large for injection or pieces having sections so thick as to result in excessive shrinkage if made by injection. Examples are Greyhound Bus window shades and Army foot tubs.

Tenite II lends itself successfully to continuous extrusion, without the use of solvents, into a variety of shapes—rods ranging in size from monofilament threads to two-inch bars; tubing in square, hexagonal, round, or any other desired form, with smooth or fluted surface, and webbed, cellular, or slotted cross-section; decorative strips of widely varying profiles; and transparent sheeting to be formed into containers, toys, protective coverings, and the like by a number of methods.

The use of butyrate molded over metal cores or inserts has become widespread—the object being to couple the beauty, toughness, and pleasant "feel" of the plastics with the rigidity of the metal. Outstanding examples of this are automobile and truck steering wheels. The coefficient of expansion of most plastics materials, including cellulose ester plastics, is approximately ten times that of metal, which means that when the temperature drops from 70° F above zero to 40° F below zero, the difference in contraction in the 52-inch circumference of the steering-wheel insert is almost ½″ more than that of the plastics. The resilience and toughness of *Tenite II*, however, compensate for this contraction without the wheel's breaking.

This plastics is also made in the form of melt-coating compositions for the impregnating and coating of paper and fabric. Coatings are applied by roll or other methods from a hot mixture which hardens at room temperature and results in a waterproof, flexible, and brilliant-surfaced finish. The composition effects a high degree of translucence of paper, improves its wet strength, and enables sheets of paper or fabric to be laminated together.

The same composition dissolved in castor oil, with a small amount of rust-preventive oil added, becomes a coating for

Combination desk tray and removable segment of card file are molded of "Tenite II." When file has been completely filled, segment may be transferred to a large file wheel

rrodible metal tools and parts in shipment or storage. rticles dipped into the hot liquid mixture are given a ating which solidifies at once into a continuous, tough, ansparent film, easily cut and stripped when desired. No ldditional wrapping is necessary. The use of butyrate strip atings makes possible complete visual inspection and iden- fication of the coated object.

Gel lacquers made from butyrate granules dissolved in itable solvents form hard, tough coatings on cores of etal, wood, and certain plastics for applications such as ds, towel bars, and handles of kitchen utensils and tools. el lacquering provides an inexpensive means of covering rticles more quickly, and with a coat much thicker, than an be accomplished by the use of ordinary lacquers. The sult is a lustrous, colorful surface, chip-proof and pleas- nt to the touch. Coatings may be applied in different icknesses by dipping in gel lacquers of varying viscosities r by repeated dipping. Mechanical adherence is obtained y the shrinkage of the gel lacquer around the dipped object uring drying. Upon cooling and partial loss of solvent, the ot, viscous coating sets rapidly to non-fluid gel. Upon omplete evaporation of the solvent, ultimate hardness is btained. END

Photographs courtesy Tennessee Eastman. Fishing rod containers are xtruded by Extruded Plastics, Inc., and manufactured by Horrocks- bbotson.

Spring Tension Fasteners

(*Continued from page* 50)

The Simmons Quick Lock device fastens and unfastens with a quarter-turn. It is designed with a self-ejecting stud and is made for three types of studs: namely, flush head, oval head, and wing head. This fastener eliminates side play and holds end play to a maximum of .008". It has a hollow one-piece housing which is integral with locking lugs. Inside is a long-travel helical spring which ejects the fastener when unlocked. The outer housing contains the spring and the inner housing. In fastening two plastics sheets together, the stud enters the collar and is depressed against the spring action. Then it is turned until it rides under the cam surfaces. This fastener is extensively used in aircraft assemblies, on engine cowlings, access panels, frame assemblies, etc. Another Simmons one-piece fastener locks by means of a spiral curved wire running through the stud and bracing against the assembled material. It also locks and unlocks with a 90° turn.

In all of these fasteners the spring-tension, or resilient

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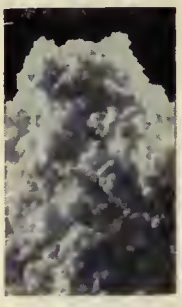

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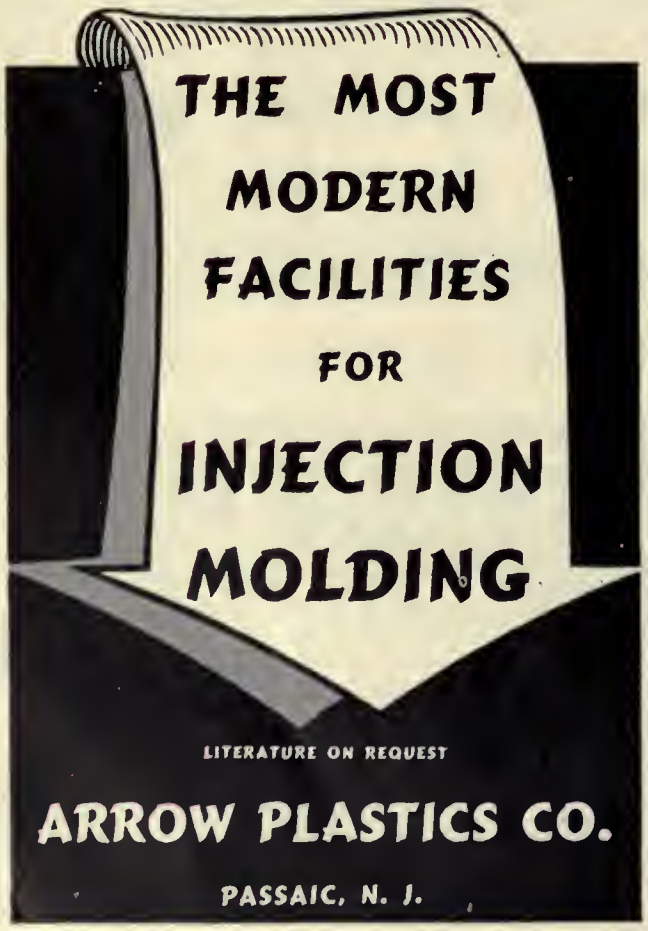

cushion, principle has been employed in some form or other. This was an obvious necessity because of the nature of plastics materials, whether compression or injection molded. The advantages attained by the use of these new fasteners have been the elimination of vibration loosening, a marked reduction in weight, a saving in assembly time, and the development of a more secure assembly which can be installed in smaller space and tight corners.

Plastics themselves are being increasingly developed as fasteners. For example, cap screws and nuts manufactured from black *Tenite* by the S. S. White Plastics Division, New York City, are used to attach electrical instruments to panel boards, often made of plastics also. Because of their high dielectric strength, these screws provide insulation and thus are preferred to metal ones for the purpose.

The screws are one inch long, with a ¾" threaded shaft, ¼"-20 thread, and a hexagonal socket head. In the injection molding of the parts, *Tenite* is held to close tolerances to assure proper fit between nut and screw.

Another fastening device for plastics that has been developed within the past year is the plastics expansion rivet. (See July, 1944, and Sept., 1945, ***plastics***). Working with acrylics, ethyl cellulose, and cellulose acetate-butyrate, engineers at the El Segundo plant of the Douglas Aircraft Company designed a rivet which can be installed with the aid of compressed air. The rivet is center-bored to within a short distance of the bottom, and compressed air is directed into this pocket while driving. Prior to driving the rivet is heated to soften the plastics. When compressed air is blown into the pocket, the bottom end of the rivet expands or "balloons." As the expanded section hardens on cooling, the rivet clinches firmly into place.

Although the expansion rivet was designed primarily for attaching fabric to the metal frames of airplanes, a number of new uses have been suggested. For example the parts of an all-plastics drawer pull can be securely fastened together with it; radio chassis can be assembled with it, and it can be used in the building trade for much of the interior wall decorations, such as the fastening of panels for decorative use. Another suggested application is in riveting plastics conduits and distributions boxes to their fittings. ENI

Protecting Electronic Equipment

(*Continued from page 62*)

other respects, it can be used at present only as a woven fabric and is not adaptable for terminal strips or socket bases, which are particularly vulnerable parts.

The other mechanism of deterioration involves a film of dust, oil, grease or similar stratum on which the fungus can take root and feed. In this case, the film takes the place of the surface of the equipment itself as a source of nutriment, owing to the carbohydrates it has picked up in minute quantities. As the fungus germinates, feeds, and functions, it gives off waste-products which are corrosive. It is these products that attack the surface through the film etching and, in time, rotting it away. Even glass may be etched by hair-lines in this way.

There are two broad classifications of fungi according to their *modus operandi*. The first type, like *aspergillus niger,* is a surface grower only. It does not eat away at the surface of the materials but merely covers it with a film or mass of cottony fluff. This causes electrical breakdown owing to "bridge gaps" and other disturbances. The other type damages the surface directly by eating it away. An example is *chaetomium globosum.* These rotting organisms chiefly attack cellulosic materials. If unchecked, they will not only interfere with the functioning of the equipment but will in time destroy it completely.

The day of molten wax as a protection for radar and electronic equipment is practically over, added Nechamkin. Plastics has won its spurs in the battle against the deadly fungus. The exact type which should be selected depends on many factors, among them the particular requirements of the instruments, the unit cost of manufacture, and working or operating conditions.

For coil impregnation, the plastics must meet several important requirements in addition to high fungus resistance. Among them are a high melting point, high resistance to fire (though this may not be mandatory), high moisture resistance, low cold flow, high resistance to vibration and to chemicals (especially ozone, oxides of nitrogen, and the industrial fumes to which the equipment might be exposed), and good dielectric properties. The plastics should not get brittle at the –60°C that prevails in the stratosphere.

The economic factor may still operate in favor of wax coatings for less expensive, personal pieces of electronic equipment like the walkie-talkies, for example. For industrial and navigation purposes, like ice-berg detectors at sea, plastics protection is a "must." Nechamkin and his associates are developing new and better plastics for this purpose, but the materials and processes may not be divulged at the present time.

Important developments in radar and television, stimulated by war needs, have assured a boom market for electronic devices in the coming decade. This is expected to mean a tremendous demand for plastics protective coatings of parts and equipment. In the field of television alone, the use of plastics for component parts of transmitters and receivers is expected to rise phenomenally. In all electronic equipment, especially the more elaborate kind, chassis, terminal strips, lugs and resistors will all be protected with fungus-resisting plastics. In many cases, the entire equipment will be housed in plastics cabinets. END

New Vistas for Hats

(*Continued from page* 25)

body—except that it requires no special sizing. The crown of draped fabric provides the necessary contrast and ties in with the fabric of the costume. Many different effects for hat bodies can be achieved by using the extruded materials in varying thicknesses and employing new weaves and patterns.

In using the less pliable types of plastics, care must be taken to attain a certain effect of softness by clever methods of fabrication.

In Sketch No. 4, a large capeline is made of cellulose acetate formed or, better still, molded into a classic shape which is likely to remain in fashion for some time. The effect of softness, so vital in millinery, is achieved by the ingenious placing of apertures, or slots, through which to pull soft, drapy materials or ribbons. Varying the distribution of these slots makes possible many different effects. A novel idea is to allow the individual to change the draping and color to match the costume.

The comparatively light weight of this material and its attractive color range, which can be governed by the textile color card to tie in with the season's demands, make it a candidate for volume business.

In this scarf for head or shoulder (Sketch No. 5) the extrusions of *Tenite II* are fashioned into a finely-patterned all-over lace which is reminiscent of the delicacy and old-world charm of the lace in a Rembrandt painting. For formal and dinner wear this scarf will add a glamorous note to any costume. It will not crush easily and will retain its freshness indefinitely.

Sketch No. 6 shows a not strictly formal wedding or con-

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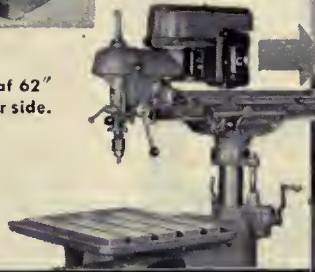

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Gossamer light veil, including the tiny petals and lace edging, are made of cellulose acetate butyrate

firmation veil—an application of cellulose acetate butyrate extrusion—in a styling similar to my award-winning design (in 1941) for an elaborate bridal veil. The fine, glistening strands of this extrusion are crocheted by hand into tiny petals which form the blossom trimming on the sheer tulle veil. The lace edging on the veil also is made of butyrate. The bright, sparkling gleam of the crystal clear film creates the effect of an ethereal aura over the wearer's head which is quite ravishing. The veil is made up in jewel-tones and should prove a useful accessory for evening wear.

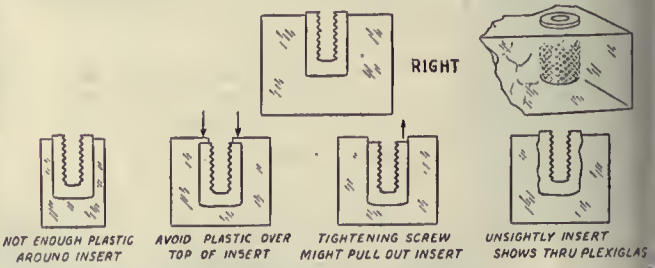
These suggestions have barely scratched the surface of plastics applications in the fashion field, and they deal with only two plastics materials out of the many available. However, I hope they will serve to stimulate the plastics materials manufacturers, as well as the fashion designers themselves. END

ED. NOTE: The author, a product designer with an important molding company, has an interesting background in the field of fashion, which dates back to Paris where she had her own studio. Her work in plastics for fashions is well-known in this country, and her experimentation with new materials has been vast and varied.

Molding Acrylics

(*Continued from page* 55)

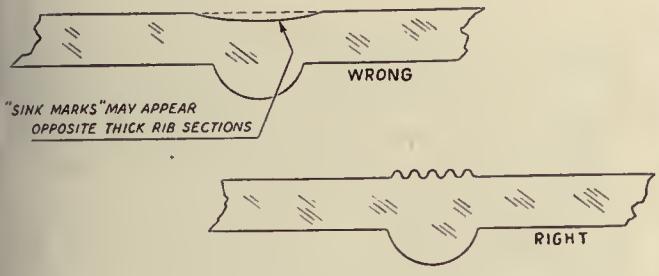
Use metal inserts to speed mounting and improve the usefulness of the part: In insert design, sufficient plastics material must be allowed to give the insert solid anchorage, to permit flow of the material around the insert and to accommodate differences in expansion and contraction between metal and plastics. (See "Inserts: Their Design,


RIGHT
NOT ENOUGH PLASTIC AROUND INSERT
AVOID PLASTIC OVER TOP OF INSERT
TIGHTENING SCREW MIGHT PULL OUT INSERT
UNSIGHTLY INSERT SHOWS THRU PLEXIGLAS

Selection, and Use," ***plastics,*** January, 1946.) Particularly in compression molding, but also in injection molding, the insert should be short and sturdy enough so that it will not be broken, bent, or dislodged by the flow of material. The proportion of depth to diameter should not be more

than 2:1. Inserts should either project above the surface of the plastics or at least be flush with it. A narrow lip of plastics between an insert and a bolt, for example, is subjected to high stresses if the bolt is tightened. Because of the transparency of *Plexiglas*, the design of the exterior of the insert should be considered for appearance's sake.

If ribs are used to reinforce flat area, break opposite surface with fluting or other decorative device: During cooling, molded sections contract and shrink roughly in proportion to the volume of material at any given point. If the volume varies, as in the case of a rib reinforcing a



flat area, excessive contraction of material will show up—not on the domed surface of the rib, but on the flat (presumably exterior) surface. Such "sink-marks" can often be eliminated by exact control of the molding cycle; but such critical control is not always possible or economical. It is therefore preferable to break the surface opposite the rib by a fluting or other decorative device on which sink-marks will not appear.

Give special surface treatment to parts which will be subjected to scratching in service: Rope effects, fluting,

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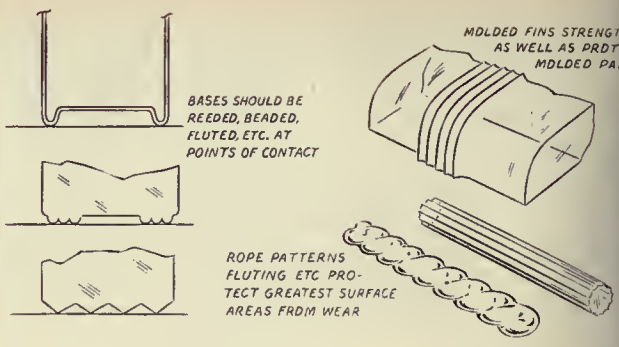

BASES SHOULD BE REEDED, BEADED, FLUTED, ETC. AT POINTS OF CONTACT
MOLDED FINS STRENGTHEN AS WELL AS PROTECT MOLDED PARTS
ROPE PATTERNS FLUTING ETC PROTECT GREATEST SURFACE AREAS FROM WEAR

reeding, and other surface treatments not only add to the sparkle of acrylic moldings by breaking the surface into a number of facets to catch and reflect light but also reduce the visibility of any slight surface scratches the molding may receive from rough handling.

Obtaining maximum glitter in moldings: Refrigerator door handles, radio dials and bases, door knobs, trays, and automotive and electrical appliances are applications where the sparkle of the plastics can be accentuated by cutting or molding facets into the back surface. (See "How to Make the Most of Acrylics", ***plastics,*** June, 1945.)

Three-dimensional moldings: The crystal clarity of *Plexiglas* is used indirectly in three-dimensional moldings, as where the front surface is smooth; a seal, trademark, or other marking is molded into the back in different depths; and appropriate colors are wiped into these markings and a background color is applied. This type of molding offers obvious possibilities for nameplates, jewelry, compacts, containers, and other decorative parts. Precautions to be ob-

Properties of Molded "Plexiglas"*

Property	Value
Optical Data	
Light transmission (%)	90-92
Haze (%)	3-10
Refractive index (N/D)	1.48-1.50
Dispersion (N_F-N_C)	0.008
Effect of sunlight	Very slight
Effect of age	Very slight
Optical density	0.036
Transmissible wave lengths (A)	3600-10,000
Permanence (% transmission loss in 200 sunshine hours)	1
Mechanical Data	
Specific gravity (25° C)	1.18-1.19
Tensile strength (psi)	4,000-6,000
Elongation at break (%)	1-5
Flexural strength (psi)	10,000-15,000
Compressive strength (psi)	10,000-15,000
Hardness	
Mohs	2-3
Rockwell (M)	70
Brinell (500 kg, 10 mm ball)	18-20
Impact resistance, ASTM Charpy, unnotched bar (ft lb)	2-4
Modulus of elasticity (10^5 psi)	3-4
Coefficient of expansion (10^{-5}/°C)	8-9
Water absorption (% max. weight gain 24 hr)	0.6
Electrical and Thermal Data	
Dielectric constant	
60 cycles	3.4-3.6
1,000 cycles	3.2-3.4
1,000,000 cycles	2.5
Dielectric strength (vpm, 60 cycles)	
Short time test	500
One-minute step-wise test	400
Power factor (%—ASTM Method D-150-36T)	
60 cycles (Bridge method)	5-6
1,000 cycles (Bridge method)	6-7
1,000,000 cycles (substitution method)	2-3
Volume resistivity (ohms/cm³)	Over 10^{15}
Thermal conductivity (10^{-4} cal/sec/sq cm/°C/cm)	4-6
Resistance to heat (°F cont.)	120-140
Specific heat (cal/°C/gm)	0.35

*Since "Plexiglas" is a thermoplastic, its properties will be found to vary with temperature. Values given apply for 25-30° C (77-86° F).

Chemical Data

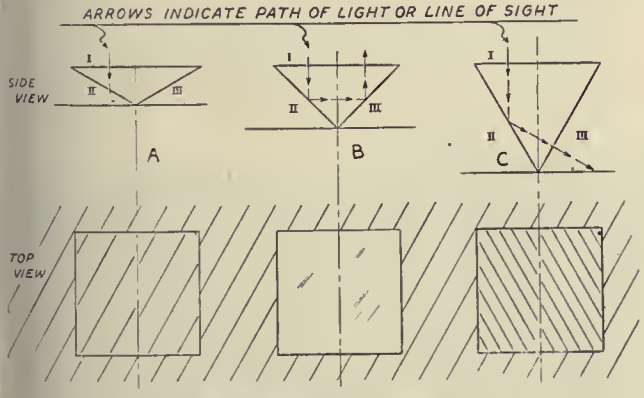
Solution	Per cent Weight Gain (192 hr at 25° C (77° F))*
Sulphuric acid (30%)	0.6
Sulphuric acid (3%)	1.0
Hydrochloric acid (10%)	0.7
Sodium hydroxide (10%)	0.8
Sodium hydroxide (1%)	1.0
Nitric acid (10%)	0.9
Acetic acid (5%)	1.0
Oleic acid (100%)	0.0
Sodium carbonate (2%)	1.0
Sodium chloride (10%)	0.9
Ammonium hydroxide (10%)	0.9
Hydrogen peroxide (3%)	1.0
Distilled water (100%)	0.9
Gasoline	0.2
Ethyl alcohol (95%)	Dissolved
Ethyl alcohol (50%)	Dissolved
Acetone, ethyl acetate, ethylene dichloride, carbon tetrachloride, toluene	Dissolved

*All concentrations given in % by weight in distilled water. A change in weight of 1% or less is considered negligible.

served in this type of molding are: (1) The depth of letters, seals, etc., should not be over one-half of total thickness of molding to permit proper flow of material; and (2) Paints and pigments which do not harm the plastics should be used (In general, the four-hour enamels are satisfactory, but the solvent base lacquers are not).

A wide range of colors is possible because of the clarity of the plastics. The light tints are very delicate, and excellently suited to hair brushes, cosmetic containers, compacts, and ladies' accessories. The darker shades have rich depth for use wherever stronger colors are more appropriate. Interesting multi-tone effects are possible, particularly with tints, by designing parts of varying thicknesses. Thicker sections are deeper in color than thin sections. Molding powders are available for injection and compression molding and for extrusion in reds, ambers, yellows, greens, aquamarines, blues, violets, white, opaque, brown opaque, and black opaque.

Continuous extrusion is a fast and economical method of production often possible where the design of the cross section or profile is uniform, the product assuming approximately the same cross section as the die. It is sometimes difficult to extrude thin fins in combination with thick sections, and there are some limitations on the included area of the profile. It is advisable that these questions be discussed with an experienced extrusion molder before a design is frozen. END



If prism angle is less than 42.2°, vertical light on Surface I (A) passes through Surface II. Pattern on horizontal plane touching prism apex is distorted by refraction, but visible. For 42.2°-45.9° (B) light on I reflects from II and III back out I. Pattern is not visible. For 45.9°-74° (C) light reflects from II, is refracted through III. The visible pattern is reversed, being a reflected image. Where only top is visible, B outglitters C. Otherwise, C glitters more since it reflects light from both sides also. Most side light ordinarily comes from II or III of B

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SPE Convention and Exhibit

Typical scene at Exhibit shows inquirer, booth attendant

ABOUT 500 members and an additional 250 non-members attended the second annual meeting of the Society of Plastics Engineers held at the Rackham Memorial Building, Detroit, on January 7, 8, and 9. Twenty-five papers were presented at the meeting, grouped around the subjects: Materials, Molding Techniques, Laminates, Tool Design, Coatings, Consumer Specifications, and Product Design. Most of them were in the nature of outline-reviews of their particular topic, a very few being reports of original research or investigation. Abstracts of some of the papers will be presented here, and of others in the March issue.

At the banquet held on January 8, the Ford Ramblers entertained, and the featured speaker was Jack Carlyle of the *Detroit News*, who gave a vivid eye witness account of a campaign in the Philippines. The serious lecture session closed with a funny talk on plastics "Products of the Future" by an alleged Herr Professor Dr. Heinrich Bulchdorf, who pointed up the virtues of some weird contraption cooked up by Barnes & Reinecke on a designers' spree.

Officers of the Society for the year 1946 were also elected at this time. They are: George W. Clark, President (Owens-Illinois Glass); Harry McGowan, Vice President (Bakelite Corp., Detroit); J. O. Reinecke, Treasurer (Barnes & Reinecke); and Thomas E. Orr, Secretary (Plastic Engineering, Inc.).

Opening on the same day as the meeting, a Plastics Exhibit was held under the auspices of the Society at Convention Hall for five days. With an admission charge of $1, it attracted an estimated 15,000 visitors. Some 60 materials suppliers, machinery manufacturers, molders, fabricators, and publishers participated. Most of them displayed familiar products, but there was also a considerable sprinkling of new products and novelties. Some of these of outstanding commercial interest, will be reported in detail in forthcoming issues of ***plastics.***

Several may be mentioned briefly here. At the B. F. Goodrich Company booth, an auto top based on polyvinyl chloride was shown. This material is produced by the Masland Duraleather Co. under the trade name *Duran*. At the Plax Corp. booth *Polyflex* sheeting was demonstrated. Made of oriented polystyrene, the thin sheet, under heat shrinks in size, but retains its shape; and if it is punched

the hole or design also retains its form. So far *Polyflex* has been used to produce buckles and buttons which, designedly, do not have a machine precision look about them.

At the General Electric Company booth, tough slabs of silicone-glass fiber laminates were on display, reportedly for the first time.

Styraloy pipe was coated with dry ice (solid carbon dioxide) at the Dow Chemical Company booth to demonstrate the retention of flexibility of this new material at low temperatures.

A "double feature" was presented at the Hydraulic Press Manufacturing Company display. Here its latest model of injection press 350-H-16 was put on view, and the co-feature was what may be called the first "commercial" demonstration on this machine of the molding of *Forticel* (cellulose propionate), the new plastics recently announced by the Celanese Corporation of America and now in pilot plant production. A four-cavity die turned out in 50 seconds or less two completely finished glossy maroon containers weighing 16 oz, aside from sprues and runners.

Among other items attracting crowds were the demonstration of the Sav-Way heat-sealing "Sara-Sealer" and also its "Pace-maker," a 2 oz vertical injection press; the display of German Plastics at the SPI booth; the Defiance Machine Works preforming press; and the Fiberglas laminate auto fender and hood.

Abstracts of the papers follow:

Dr. S. D. Douglas, "New Plastic Developments During the War in the U.S.A.": This paper was in the main a discussion of improvements and modifications in certain vinyl resins during the past four years. Progress in general was said to include improved plasticizers, better manufacturing techniques, improved dispersions (organosols, plastisols, and hydrosols were discussed), improvement in quality and increase in the uses of polyethylene and polystyrene (especially a higher softening temperature for the latter), development of polytetrafluorethylene (a new product and potentially very important, with properties similar to those of polyethylene; made by the polymerization of tetrafluorethylene), development of vinylidene chloride-vinyl chloride copolymers, and, last but highly important, the development of the allyl resins, especially for laminating.

Alexander Nixon, "Plastic Materials in Automotive Construction": A survey of plastics in the automobile and facts on the setting up of tests to simulate actual use conditions in attempting to evaluate various plastics for particular uses in the automobile. The total weight of plastics in the 1942 *Pontiac,* exclusive of the vinylite sheeting used for the laminated glass, was 3.13 lb distributed as follows: phenolics, 1.22 lb; acetates and acetate butyrate, 1.28 lb; methacrylates, 0.60 lb; urea formaldehyde, 0.03 lb. Vinylite

Seated at Annual Banquet, William B. Hoey, retiring president, is flanked on his right by George W. Clark, newly-elected president, and by P. F. Robb, master of ceremonies

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sheeting accounted for from 2 to 3½ lb depending upon the body style.

Dr. H. A. Winkelman, "Plastics in the Rubber Industry": This talk went into detail on combinations of plastics and rubber, and indicated an extent of interrelation not commonly known. Among the plastics so used are polyvinyl chloride, polyvinyl vinylidene chloride, polyvinyl alcohol, polyvinyl butyral, styrene polymers, polyethylene, nylon, etc. Characteristics contributed by one plastics or another to rubber-plastics combinations include resistance to sunlight, ozone, water, oils and solvents, acids, alkalis, and salts; non-flammability; good electrical properties; colorability; non-toxicity; absence of odor, etc.

W. Goggin, "German Plastic Fabrication Methods": Plastics production in Germany and the United States was compared for 1943 to show the comparative extent of the German plastics industry. Conclusions from a first-hand inspection of plastics in Germany were that fabricating development was spotty, both good and bad; injection molding was poor; foam development was good; coating was poor; and extrusion was rather good.

W. S. Prendergast, "Special Extrusion Molding": This paper discussed a new process of injection molding with an extruder. Sections were shown weighing 3½ lb molded by the new method, which used two molds alternately on the front of a conventional screw-extruder. As much as 100 lb an hour have been injection molded through a 2½" machine. Advantages include large moldings, cheap molds, perhaps a more uniform plasticizing action, no tendency toward laminar structure, and the tendency of materials to strain relieve themselves. On large sections the extrusion molder can probably produce more cheaply a larger quantity of shots at a lower cost than the majority of injection molders, who are necessarily tied to a fairly small machine and therefore a fairly low production rate.

Dr. Simon Williams, "Cotton in Relation to Laminates": This was a discussion of preliminary studies on the properties of cotton fibers, yarns, and fabrics which influence their use in laminates. Influences of fiber lengths, twist in yarn, fahric structures, sizing and the effects of de-sizing, etc. were discussed in many of their ramifications. The principal object in the research was to increase some of the mechanical properties of cotton-reinforced laminates, especially the tensile strength.

(To be continued)

Photographs courtesy of *Chemical and Engineering News*

Machining Polystyrene

(*Continued from page* 58)

work. Taking a 1" cutter as a standard, spindle speeds as high as 20,000 rpm may be attained if coolant is applied liberally, but generally 15,000 rpm or lower is satisfactory. The rotational speed of the work should vary between 100 and 600 rpm, depending on its character, thickness of material, and the skill of the operator. Solid material can usually take the 600 rpm speed; hollow material should be rotated more slowly. The rotational speed of the work should be further cut for safety purposes in internal threading operations.

In all threading and tapping operations, regardless of the machine, method, or tool used, coolant should be applied freely.

Milling

In milling, as in most other machining operations on polystyrene, there should be liberal use of coolant. The cutter is high-speed steel, with the clearance angle varying from about 12 on a ⅛" cutter to about 4 on a 3" cutter. The operating speed may be regulated to about 400 fpm, varying

from that speed on the basis of the width of the cutter. Feed rate should be reduced, as usual, with increasing width of cutter and depth of cut. With a ½" cutter, only about ⅛" cut should be taken in a single pass, while with a two-and-a-half-inch cutter, the cut should not be over 1/16".

Shaper and Router

Shaping and routing are numbered among the operations in which coolant is not required for work on polystyrene, but, in both cases, feed should be controlled and unforced. This is especially true if a multiple-toothed cutter is in operation on the shaper. There should be ample clearance on cutters for this machine. A clearance angle of from 40° to 47° is usual. The operating speed is normally about 7200 rpm and, with careful feed, this speed may be maintained for most tool diameters and for most types of cut. Router operations may be performed at a spindle speed as high as 18,000 rpm, under the same considerations obtaining for the shaper. There is one exception to the fact that coolant may be dispensed with in router operations, and that is in the case of very small tool diameters. The clearance in very small tools may be too slight for rapid disposal of chips, in which case coolant may prove necessary. A couple of test cuts can decide this question.

Sanding

The low softening temperature of polystyrene and its tendency to gum under rather low frictional heat puts dry sanding out of the question. However, polystyrene will take wet sanding. Even then, the jointer is preferable and will provide a cleaner finish for straight surfaces. Where the sander must be used for curved and other compound surfaces, the work should be fed lightly to a medium grit. Pulley speed is determined by the character of the work, by the size of the area in contact with the belt, and by other considerations. It will ordinarily be determined by test. Generally, pulley speed should lie between about 900 rpm and a maximum of about 1500 rpm.

Polishing

Polystyrene, like most other plastics, should take a two-phase polishing—one with polishing compound and the final one without. The buffs for both polishing operations are usually about 10" in diameter and are made of cotton flannel. The width should be from 2" to 4", but may be smaller where it is necessary to reach complexities in the surface to be polished. The distribution of leaves and spacers differs between the two buffs. The buff for the

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first polish should have a ratio of one leaf to one spacer, while that for the final polish should have two spacers to one leaf. The first buff should receive periodic applications of red rouge and tallow in the course of the work. Most old hands at this job prefer separate sticks of rouge and tallow, rather than one combination stick, because the individual sticks afford better control of the proportions of compound applied to the buff. In fact, no more than a touch of tallow is needed in polishing polystyrene. The buff for the final finish should be dry. Both buffs, operated at about 2000 rpm, may be mounted on the same spindle.

Since all plants carry oils of one kind or another on the premises, especially lubricating oils for machines, it is well to remember that polystyrene will dissolve in many of these types of oils, as well as in gasoline and kerosene. Consequently oil-filmed hands and oil-stained rags should be kept away from polystyrene stock and work. END

Plastics in Boats

(*Continued from page 66*)

sails can be made fireproof even without the plastics treatment.

The coating may be either transparent, translucent or opaquely colored. The transparent kind is advantageous for printed fabrics to permit the pattern to show through. Every color of the spectrum is available, so that beauty of color and texture is joined to utility. Chairs may be upholstered in *Koroseal* itself. The surface is satin-smooth, resistant against wrinkles and waterproof so that one can sit down on it in a wet bathing suit with perfect assurance that the upholstery will not be damaged. Deck chair cushions and cabin window-draperies can be coated in colors that harmonize with the general decor.

The cost of the coating hinges on whether the fabric is coated on one or both sides, whether it is thoroughly impregnated, and how thick the surface coating is. In any event, the treatment means long range economy as the coating does not deteriorate with age or rot the way untreated fabrics do under sea conditions.

Fire Protection

An important feature of the coating is its fire-resistant qualities, for fire offers a particularly dangerous hazard at sea. Diesel engine boats throw up particles of red-hot molten oil which sometimes drop on inflammable deck awnings and set them on fire. Crews are trained to be on the alert with extinguishers to spray the awning tops. In yachting and ship yards, also, the danger is ever-present. These hazards are avoided by coating awnings, tarpaulins and winter covers with plastics. One type of fireproof upholstery used on combat ships consists of strong, fine count high twist cotton-base fabric coated with vinyl chloride resins. Suspended for 12 sec. in a Bunsen flame, it burned for less than two seconds after removal from the flame. Navy bedding bags employ a plastics-coated sateen fabric as a covering for mattresses or for the storage of miscellaneous garments. The coating has been found to offer excellent protection against sparks and incendiary fragments, which readily ignite uncoated bedding and loose garments.

Our company looks forward to an expanding peace-time future in the marine industry for vinyl and other plastic coatings. Their efficiency, dependability, durability, and other qualities—proved in the stress of combat—make them peculiarly adaptable for canvas and fabrics of all kinds exposed to the same winds that blew and waves that rolled in war time. END

Old Titles in New Jackets

(*Continued from page 38*)

ored cover designs which distinguish these books to show ough to full advantage. Unlike the cardboard case, the e of acetate is scuffproof, so that no raggedness develops der frequent handling. Durability is great. And a ghtly damp cloth, which cannot be repeatedly applied to aperboard case without ultimately warping and peeling will wipe the acetate case clean.

Aside from the great saleability of the book, the acetate pcase presents equally distinct advantages to the book-ler. First, the book gets excellent protection while it is display, and yet it remains fully visible to the customer all times. The acetate case considerably diminishes the gbear of the shop-worn book. The fact that the book is used in a quality case has its psychological effect on the stomer, who will be impelled to handle such a book with eater care. One of the elements that makes the acetate-pcased book a "natural" for attention-attracting display the fact that the lights reflected off the acetate tend to aw the eye in that direction; in other words, it makes for cial brilliance in the display.

The new slipcase was neither an afterthought nor a side ue. Harry N. Abrams, art editor of Grosset & Dunlap, nceived the book and slipcase together as a design unit. he outcome of this conception was his removal of the title om its traditional place on the front cover and its trans-sition to the slipcase. This left the cover free for impeded pictorial design, eliminating the necessity of her superimposing the title on the cover design or nning the design around the title.

The cover design—in four colors for some of the books the series and in five for others—is applied overall to e entire binding. There are some ten or a dozen color ates in each of the volumes in the group. The printing in two colors, black and sepia—black for the body type d sepia for the illustrations and, in several cases, for the apter headings and page numbers, especially where these

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INDEX OF Advertisers

Feb. 1946

Advertiser	Advertising Agency	Page
Aeron Mechinery Co.		10B
Accurate Moiding Corporation	Rothschild Advertising	6B
Allmetei Screw Products Co.	Firestone Advertising Service Inc.	109
American Flange & Mfg. Co., Inc.	Freiwald & Coleman Advertising	36
Americen Phenolic Corporation	Evans Associatas, Inc.	13
Amos Molded Plestics	Sidener & Ven Riper, Inc.	22
Armour end Compeny	Foote, Cone & Belding	101
Arrow Plastics Compeny	The Powerad Company	96
Austin Tool & Mfg. Co.		106
Bambergar, A.	Lee Murrey, Advertising	94
Bernes & Reinecke	Behel & Weldie & Briggs	B3
Bettalan, L. H.	Gunn-Meers Advertising Agency	106
Bend-A-Lite Plestics Division	Duena Wenemeker	4S
Boice-Crene Company	Wendt Advertising Agency	109
Boonton Molding Company	A. J. Slomenson, Associetes, Inc.	15
Bortmen Plestics Company	Lawrence F. Dutton	99
Brilhart, Arnold, Ltd.	Henri Le Mothe Agency	4th Cover
Cerdinel Chemicel Co.	Feldmen, Lefler, Inc.	106
Catelin Corporetion	Welter J. Gallegher, Advertising	2nd Cover
Celenese Plastics Corporation	Ivey & Ellington, Inc.	1B
Chicago Molded Products Corporation	Almon Brooks Wilder, Inc.	7B
Cibe Products Corp.	Cory Snow, Inc.	B2
Cinch Menufecturing Corporetion	D. T. Cempbell, Inc.	65
Columbie Protektosite Co., Inc.	United Advertising Agency	53
Consolideted Products Co.	Diener & Dorskind, Inc.	99
Continentel Can Co.	Betten, Berton, Durstine & Osborn, inc.	B
Continental Plestics Corporetion	Jim Duffy Compeny	B7
Continentel Screw Co., Inc.	Rossi & Hirshson	72
Cook, Lewrence H., Inc.	George T. Metcelf Co.	76
Cumberland Engineering Co.	Richard Thorndike	B9
Detroit Mecoid Corporetion	Welter J. Gelleghar	63
Detroit Stemping Co.	Charles Schwein Compeny	BB
Dickten & Mesch Mfg. Co.		105
Dow Chemical Company, The	MacManus, John & Adams, Inc.	33
Durita Plastics Incorporeted	Lewrence i. Evariing	43
Eegle Signel Corporetion	Bewden Bros., Inc.	B6
Eastern Tool Designers		10B
Ekstrom, Cerlson & Co.	Cummings, Brend & McPharson	10B
Electric Auto-Lite Compeny, The	Ruthrauff & Ryen, Inc.	54
Emeloid Co., Inc., The	United Advertising Agency	7
Engineering Specielties Corp.	Maxon, Inc.	96
G. Felsenthel & Sons	Llaber Advertising Co.	71
Gemloid	Commarce Advertising Agancy	10B
Gemloid Corp., The		9B
Genarel Electric Compeny	Benton & Bowles, Inc.	S1
General Industries Company, The	Fuller & Smith & Ross, Inc.	9
Gering Products, Inc.	M. C. Diadrich	70
Girdler Corporation, The	Rocha, Williems & Cleery, Inc.	17
Goodrich, B. F., Chemicel Co.	The Griswold-Eshleman Compeny	S
Greet American Color Compeny		100
Grotelite Co., Inc., The	S. C. Beer Compeny	100
Huntington Stemping & Plestic Co., Inc.		91
Hydreulic Press Menufacturing Co	The Jay H. Meish Compeny	3
Industriel Conversions, Inc.		59
Industriel Molded Products Co.	Wesley E. Sharer & Associetes	10
Kerlstad, Andrew C.		106
Kingsley Gold Stemping Machine Co.	Continental Advertising Service	102
Kirk, F. J., Molding Company	Cory Snow, Inc.	102
Krieger Color & Chemical Co.	Warren P. Fehlmen Advertising Co.	105
Kuhn & Jacob Molding & Tool Co.	Eldridge-Northrop, Inc.	85
Kurz-Kesch, Inc.	Kircher, Helton & Collett	21
Kux Mechine Co.	Kuttner & Kuttner	90
Lester-Phoanix, Inc.	Ralph Meitland	110
Meck Molding Compeny, Inc.	George Homer Mertin	12
Megnetic Plastics Co., The	Gregory Advertising, Inc.	94
Mertindell Molding Compeny	Eldridge-Northrop	81
Meyercord Co., The	C. C. Fogerty Compeny	19
Michigen Molded Plastics	Walleca-Lindeman, Inc.	41
Molded Products Corporetion	Cruttenden & Egar	29
Mosinee Peper Mills Compeny	Kleu-Ven Pietersom-Dunlap Associates	39
Netionel Lock Company	L. W. Remsey Compeny	73
Netionel Plestic Products Co., The	The Joseph A. Wilner Co.	98
Netional Vulcenized Fibre Co.	John Gilbert Creig Advertising	14
Northern Industriel Chemical Co.	The Cellaway Associetes	107
Pennsylvenie Coel Products Co.	Lee Murrey, Advertising	16
Plaskon Division, Libbey-Owens-Ford Glass Compeny	Meldrum & Fewsmith Advertising, Inc.	35
Protective Coetings, Inc.	Associeted Business Counselors	106
Redio Receptor Company, Inc.	John A. Finnermen	11
Rayon Processing Co. of R. I., Inc.	Richerd Thorndike	95
Siegel, M. B., Associetes	Creig E. Dennison Advertising	105
Silicocks-Miller Company, The	Fred H. Ebersold, Inc.	103
Society of the Plestics Industry	James R. Flenagen, Advertising Agency	61
Stevanson, H. N., Jr.		106
Stokes, F. J., Mechine Co.	McLein Organization, Inc.	6
Taber Instrument Corp.	Melvin F. Hell Advertising	107
Tarbonis Co., The	L. G. Maison & Co.	104
Tennessee Eastmen Corporetion	Fashion Advertising Co., Inc.	27
Texon Industriel Corp.		106
Universel Hydreulic Mechinery Co.	Gunn-Meers Advertising Agancy	108
Universel Plastics Corporetion	Ceyton, Inc.	69
Welker-Turnar, inc.	Thoma & Gill	97
Weterbury Companies, Inc.	Menternech, Inc.	104
Western Shede Cloth Compeny, The	Herdy Advertising	49
Worchester Moulded Plestics Co.	C. Jarry Speulding, Inc.	3rd Cover
Wrigley, William Jr., Compeny	Ruthreuff & Ryen, Inc.	93
Ziv Steel & Wire Co.	Vernon S. Wailer, Advertising	91

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are set in the wide margins. All in all, these books constitute a thoughtfully designed and beautifully executed job.

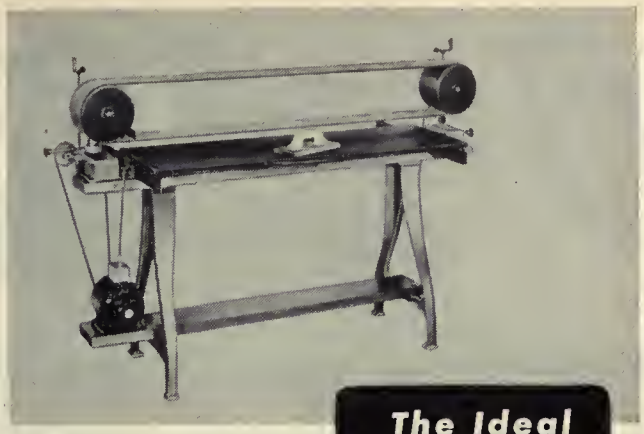
One of the most significant things about this departure in book publishing is the fact that books of deluxe execution and deluxe slipcasing are being issued at popular prices. How Grosset & Dunlap accomplish this can be understood from a glance at the interrelation of production elements involved. The acetate-slipcased book is one unit in a new group of children's classics issued as the Illustrated Junior Library. Five titles were presented in December, and ten titles will be put out for 1946. For each of the titles, there are three editions: a $1 edition with paper jacket, $1.50 edition with paperboard slipcase, and a "deluxe edition" at $2.50. The deluxe edition is the one with the acetate slipcase. The cost of the artwork is shared by all three editions. Besides that, the same plates are used for the $1.50 and $2.50 editions. The production economies effected by these two factors alone are obvious. If it were not for this, it is doubtful whether it would have been possible to produce a book of limited-editions quality at a popular price.

The importance that Grosset & Dunlap obviously attached to the acetate slipcase in contributing quality to the deluxe editions can be readily seen from the firm's willingness to allocate a comparatively high ratio of cost to it. There is a difference of only one dollar in retail price between the paperboard-cased and acetate-cased editions. Yet the acetate slipcase represents 28% of the total cost of production of the $2.50 book, while the paperboard case represents only 7% of the production cost of the $1.50 volume. While there is a price ratio of only 5 to 3 between the two editions, there is the wide cost ratio of 4 to 1 between the respective slipcases. A. A. Drucker, production manager of the firm, stated that, when cellulose acetate sheeting is more readily available, the gauge used for the slipcases will be reduced from the present .015" to .010", making possible a drop in cost percentage from the present 28 to 20, without appreciably affecting the rigidity or the general quality of the case. Even at that, the cost percentage of the acetate slipcase remains substantial and it evidences the determination of the company to utilize the potentialities of plastics in quality publishing.

Fabricating Process

The new slipcase is fabricated for Grosset & Dunlap by the Miro Container Co., of Brooklyn, N. Y. *Lumarith* cellulose acetate sheeting is cut to size and the book title is applied by silk-screen process to the flat piece. The pieces are then blanked, creased, formed, and cemented. Considerable care is exercised in keeping the work clean in various stages of its fabrication. All dust particles must be removed from the surface of the sheet before ink is applied in the silk-screen job. Dust is again a factor to be reckoned with immediately after the cementing job, for since the cement is applied under heat and pressure, a dust-attracting static develops on the acetate surface. The finished slipcase is therefore carefully inspected and cleaned before shipment.

There seems little reason to doubt that the plastics slipcase is a book-publishing development that will see widespread adoption. Whether plastics slip-casing will become general for books in the popular-priced class will depend, of course, on how far its production cost can ultimately be brought down, but it seems likely that it will become standard for at least the higher quality books. It is equally to be anticipated that we shall see interesting developments in decorative design toward which the Grosset & Dunlap slipcased books have pointed the way. One can easily visualize a design which will even more closely integrate the slipcase with the binding. An example of this would be a decorative or pictorial pattern for the book cover and another for the slipcase, each an individual design but so related that both in combination form a unit design for the cased book. END



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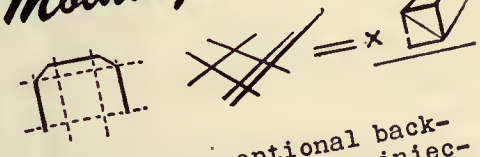

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Below—These two pictures illustrate the change from military to civilian work. The chief molding problems in making coat hangers and soap containers are to fill large-area cavities and to attain the required surface luster. In making the timing adaptor for explosives in an 8-cavity mold, it was necessary to maintain 4 different dimensions—core size, outside diameter, thread size and slot size—within the tolerance of ±.003". More than 9,000,000 adaptors were made by Lester machines without a single complaint from Government agencies. Even though these parts are made of polystyrene, which flashes easily and contains no lubricant, no flashing occurred and no polishing was necessary. This is due largely to proper plasticization in the Lester heating cylinder, and to the heavy beam-type alloy steel frame and double-toggle positive mold locking mechanism, which assure flash-free moldings at all times.

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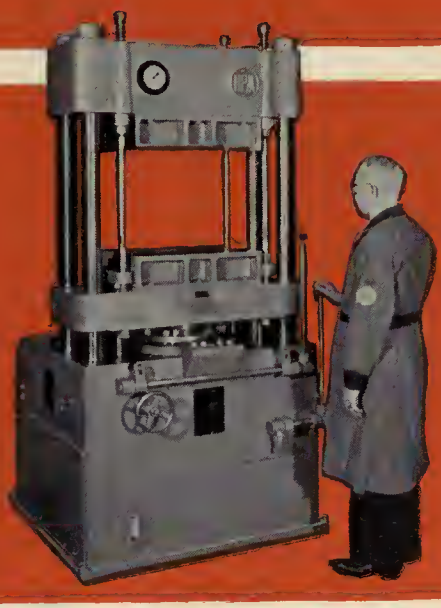
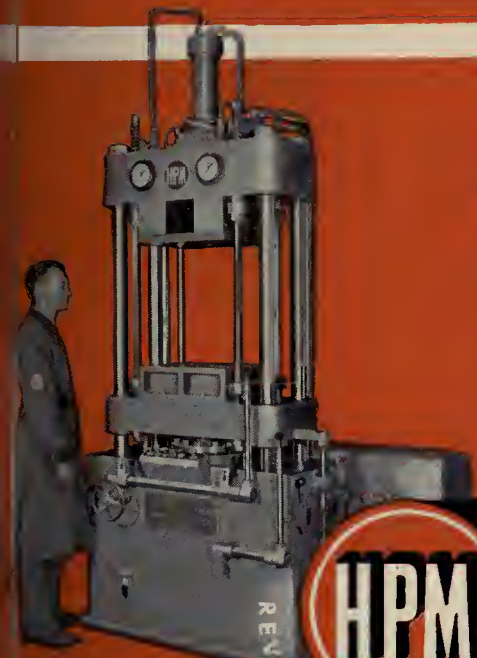
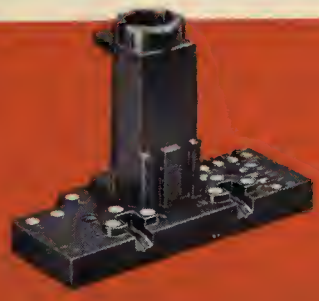




H-P-M ELECTRONIC MOLDING PRESSES for Thermo-Setting Resins



Equipped with upward acting hydraulic mold clamp and downward acting transfer ram, H-P-M electronic molding presses are designed especially for use with your high frequency material heating equipment. Each press is a self-contained unit, equipped with H-P-M oil hydraulic pumps, valves and controls. Universally designed, they are also ideally suited for conventional compression molding. Write today, stating your particular requirements.

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PLASTICS MOLDING PRESSES

MARCH, 1946

plastics

VOLUME 4, NUMBER 3

in this issue

Plasties in Perspective 50

The Buyer Says ..... *Kathleen Green Skelton* 53

What the Laminates Offer ..... *J. D. Nelson and L. V. Larsen* 62

The Molder Has His Problems ..... *Kenneth W. Macksey* 66

Machines for Better Production 75

On the Drafting Board 83

second annual directory

Table of Contents 85

Index to Materials Suppliers, Machinery Manufacturers, Molders, Fabricators, Laminators, and Other Processors 86

Comparative Guide to Plastics' Properties 141

Tables of Properties 158

Plastics Products 212

Directory of Names and Addresses 221

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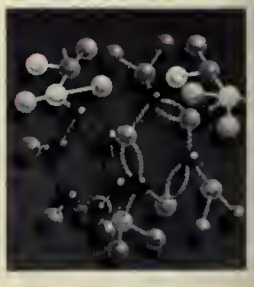

COVER

Illustrating a stage of inter re-action between melamine resin and para-toluene sulfonamide plasticizer. Links have been variegated to indicate co-valency of the atoms

Other Ziff-Davis Publications: Flying, Popular Photography, Radio News, Radio-Electronic Engineering.

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We'll hang our story on a clothesline

Desirable properties suggest uses for **GEON** *raw materials in every industry*

★

THAT clothesline in the picture is something new. It consists of a flexible rope or metal core, covered with one of the GEON polyvinyl materials. It has certain definite advantages over conventional clotheslines—all of which can be translated into improved finished products in literally every industry and in the home.

For example, the clothesline is practically age-proof—resists the effects of sun, rain, light, heat, cold. It won't crack or get gummy even after prolonged exposure to weather. It's easily cleaned with a damp cloth—no dirt or grime can penetrate it. It's mildew-proof—fungi can't enter the surface. It will wear indefinitely—pull it around hooks thousands of times—no snagging, no breaking of the tough coating. It's smooth, flexible, easy to handle. It's brightly colored for high visibility and attractive appearance.

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Geon
Polyvinyl Materials

B. F. Goodrich Chemical Company

A DIVISION OF THE B. F. GOODRICH COMPANY

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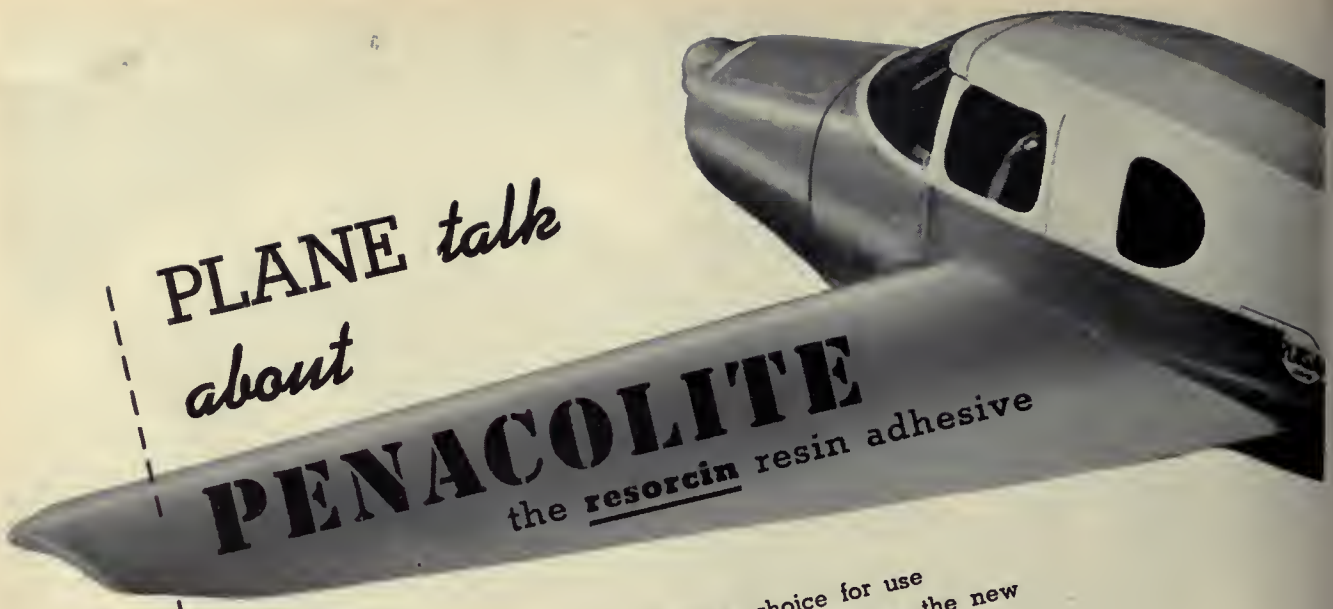

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the resorcin resin adhesive

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Photographs of the Cruisair Senior taken in midair by Hans Groenhoff

Write Department A-3

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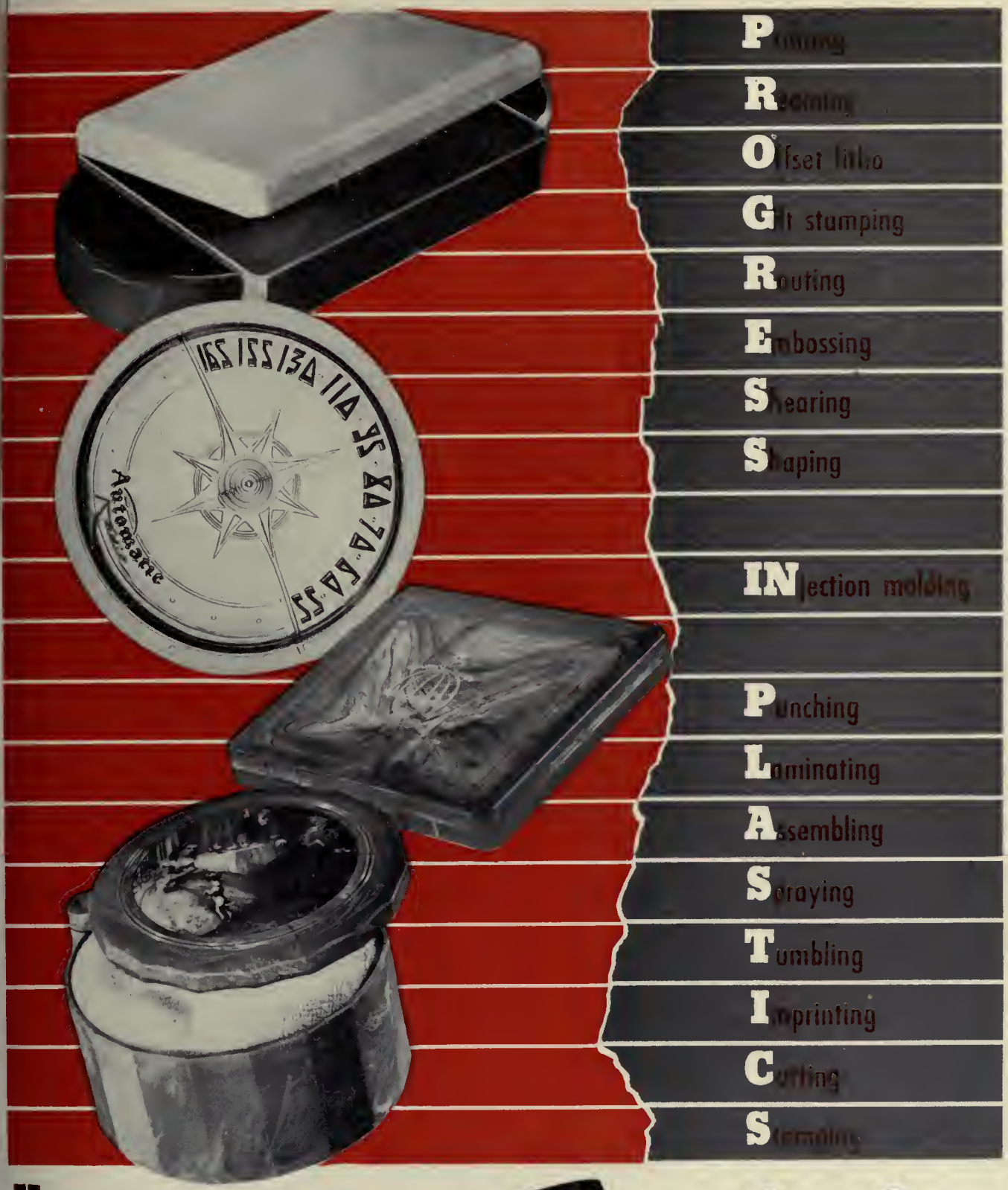

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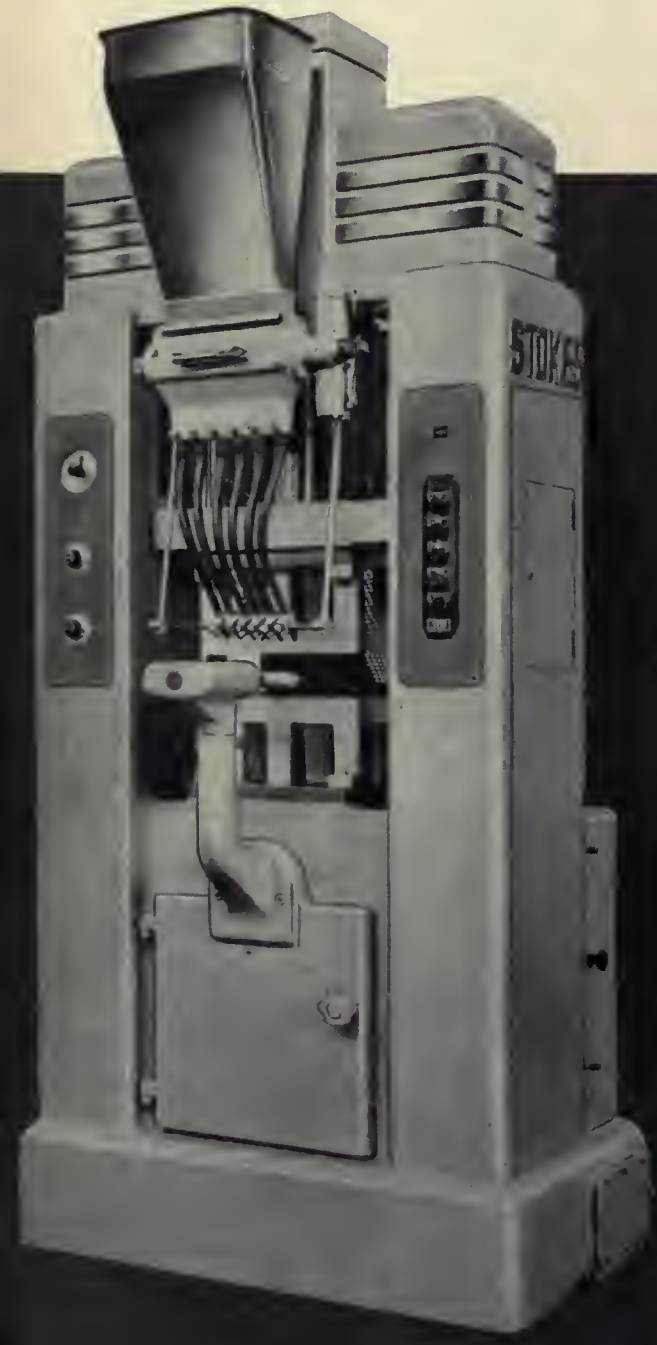

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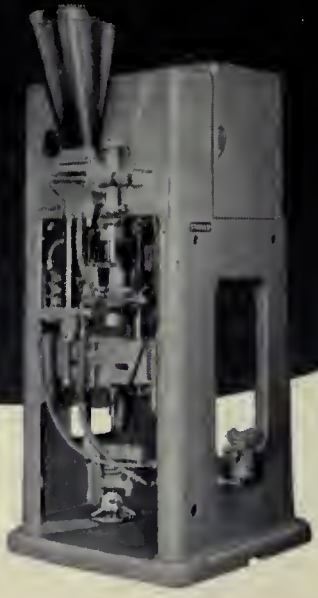

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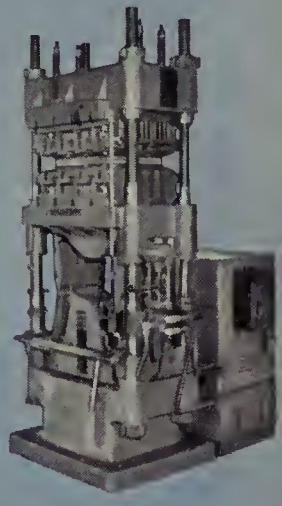

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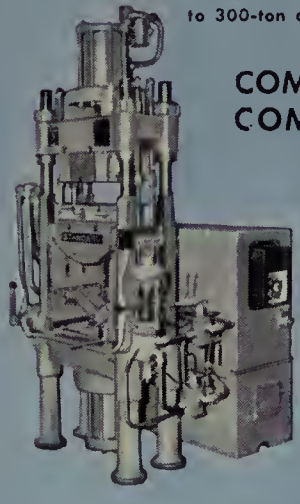

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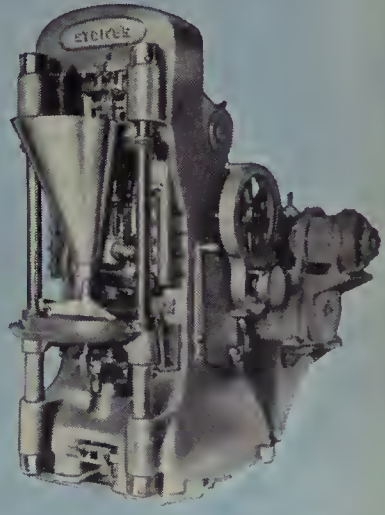

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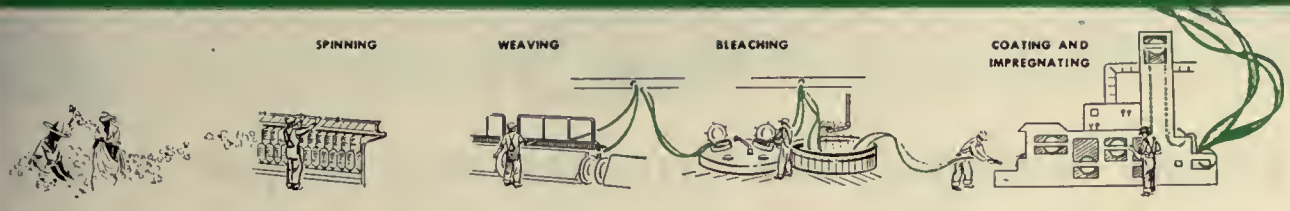

These are but a few of the items for which our plastic coated fabrics and papers will be used after the war.

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- Fast, low-cost tooling
- Corollary savings

Large or small complicated parts can be laid up and formed in one operation, resulting in a dimensionally stable monolithic or monocoque structure, having great strength with light weight. In the production of custom bodies, for example, the necessity for costly dies and machining is avoided and extremely important time and cost savings are possible.

These outstanding advantages may have an important bearing on the product you are making now or on those you now have "on the board". Get complete facts about the use of Fiberglas in reinforcing plastics. *Owens-Corning Fiberglas Corporation, 1881 Nicholas Building, Toledo 1, Ohio.*

In Canada, Fiberglas Canada Ltd., Oshawa, Ontario.

Owens-Corning Fiberglas Corporation does not manufacture resins or fabricate laminates, but will be glad to supply experimental samples of Fiberglas and data on techniques in its use with plastics.

FIBERGLAS

*T. M. Reg. U. S. Pat. Off.

CLOTHS AND MATS FOR PLASTICS REINFORCEMENT

ALIKE FROM EVERY ANGLE

Perfect duplication is essential to avoid bottlenecks and losses in production lines. General Industries produces molded plastic parts for mass assembly, combining careful workmanship and "know-how" to give maintained accuracy, appearance, utility and performance of each piece.

If your new or future products call for plastic parts, our modern facilities for transfer, injection and compression molding can handle large parts or small, in any quantity.

From blueprint to finished product, experienced engineers speed production; ingenious mold-makers, realizing that "almost alike" won't do, stress the importance of accurately placed inserts, close tolerances and finish to meet the most critical specifications. Our skillful operators turn out identical pieces that are alike from every angle—molding salability and satisfaction into your products.

For perfect duplication of molded plastic parts, depend upon General Industries.

THE GENERAL INDUSTRIES COMPANY

Elyria · *Molded Plastics Division* · Ohio

Accuracy

DESIGN

ENGINEERING

MOLD-MAKING

MOLDING

FINISHING

Since 1919 our one unvarying aim has been to supply the maximum of service at minimum cost. Twenty-six years of steady growth has proved the correctness of this aim.

ESTABLISHED 1919 TRADE MARK

KUHN & JACOB MOLDING & TOOL CO.

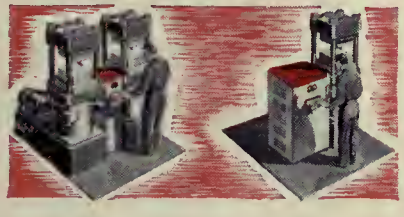
1200 SOUTHARD STREET, TRENTON 8, N. J.
TELEPHONE TRENTON 5391

Plastic Molding

NEW YORK PHILADELPHIA NEW ENGLAND

THE FIRST *LINE*

OF HIGH FREQUENCY HEATING UNITS FOR PLASTICS



IN Thermex Red Heads, Girdler offers more than one exclusive advantage:

A—a complete line from which to meet your particular needs. The range of capacities offered in fully developed, tried and proved Thermex units exceeds anything else in the field.

B—simplicity of installation. From the small model, only 25 inches high, to the biggest unit in the line, every Thermex Red Head is portable. Every one is compact for its capacity and will fit easily into present plant layouts.

C—simplicity of operation. All Thermex units are self-contained, automatic, with the built-in drawer heating compartment. High frequency energy automatically turns on when drawer is closed, automatically turns off when time cycle has been completed.

Mail the coupon or write to one of these Girdler Corporation branch offices—150 Broadway, New York 7, N. Y.; 228 N. La Salle St., Chicago 1, Ill.; 1836 Euclid Ave., Cleveland 15, Ohio.

MODEL X875—400 watt rated output. Will raise ⅓ pound of average material 170° in one minute. Height 25", Width 15", Depth 30¼".

MODEL 18X0–1000 watt rated output. Will raise ⅔ pound of average material 170° in one minute. Height 46¾", Width 13", Depth 24¾".

MODEL 28X0—1500 watt rated output. Will raise 1⅓ pound of average material 170° in one minute. Height 46¾", Width 28½", Depth 30½".

MODEL 88X0—5 K.W. rated output. Will raise 4 pounds of average material 170° in one minute. Height 79", Width 27¾", Depth 52".

MODEL 185X—8 K.W. rated output. Will raise 7 pounds of average material 170° in one minute. Height 79", Width 30½", Depth 55".

THE GIRDLER CORPORATION, THERMEX DIV., DEPT. PM 3-46 LOUISVILLE 1, KY
Please send full information about the complete line of Thermex Red Heads.

Name.....

Firm Name & Address.....

.....

Thermex* RED HEADS

*Trade Mark Reg. U. S. Pat. Off.

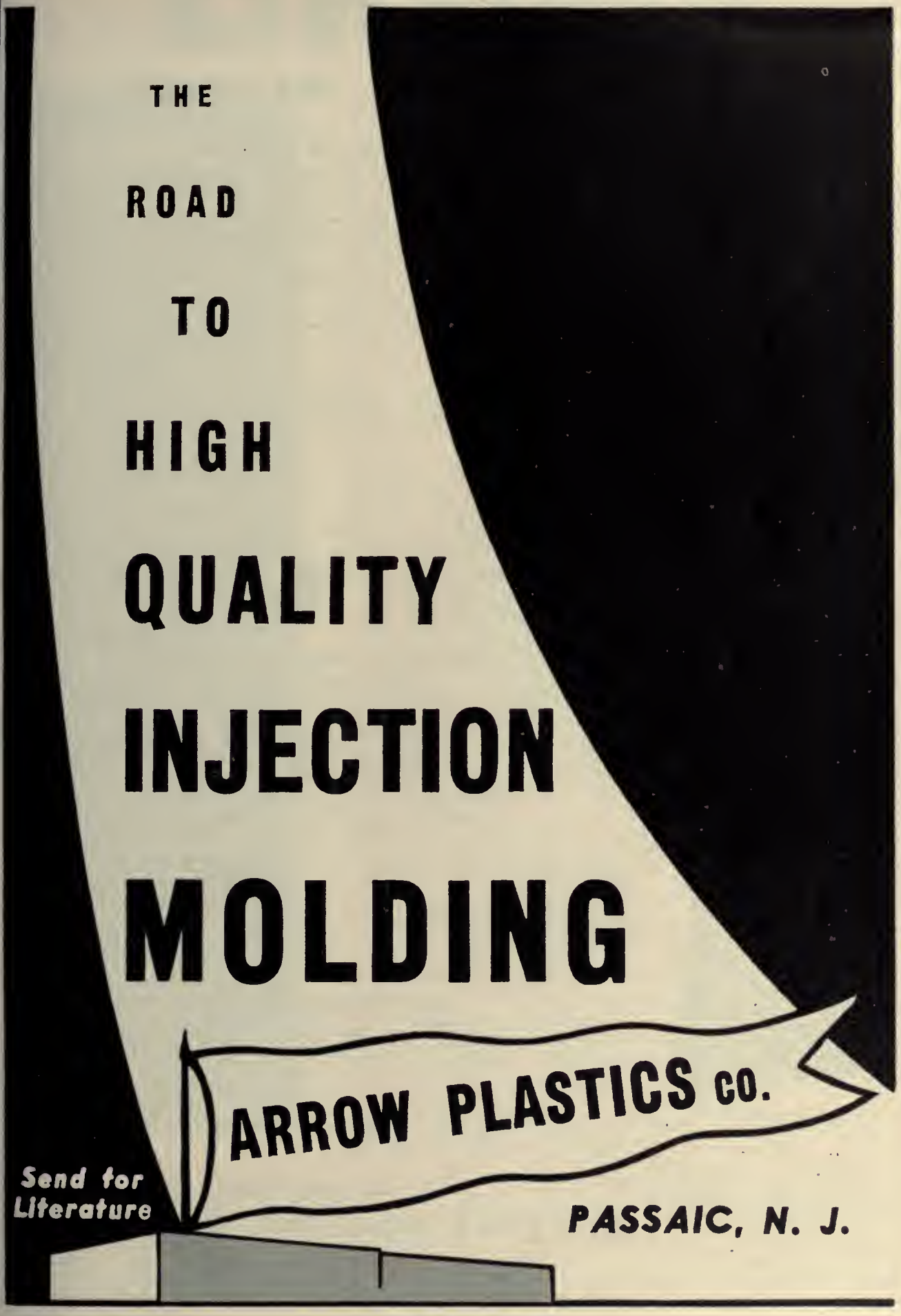
The First Industrial High Frequency Dielectric Heating Equipment

GLOBE PLASTICS FIT A MULTITUDE OF PRODUCTS...

Whether you're planning to manufacture home appliances or radios . . . furniture or toys . . . timepieces or hardware . . . plumbing supplies or some other product . . . whatever it is, there's a place in the picture for GLOBE PLASTICS because they're ideal for many purposes. Here at Globe a skilled organization with complete tool, die and mold making equipment is geared up to handle your plastic requirements promptly. Write for quotation on any products requiring either injection or compression molding.

GLOBE IMPERIAL CORPORATION

2024 KISHWAUKEE STREET • ROCKFORD, ILLINOIS


THE
ROAD
TO
HIGH
QUALITY
INJECTION
MOLDING
ARROW PLASTICS CO.
Send for Literature
PASSAIC, N. J.

DEFIANCE

PLASTICS FORMING MACHINES

No. 20

No. 152

NOTE—Shown here are only two of Defiance lines of Preform and Transfer Presses. For more information on these and larger capacity presses write to Defiance Machine Works direct.

PREFORM PRESSES

Defiance Plastic Preforming Machines are designed to produce tablets at high speed, with great accuracy, in a wide variety of shapes and sizes. Weights of preforms as well as pressure applied can be rapidly changed—without stopping the machines. Material leakage is reduced to a minimum, thus assuring cleanliness in operation. Model 20 is for large pills and wide range of shapes and sizes; withstands 100-ton preforming load. Model 10 is primarily for cylindrical shapes, either solid or perforated; withstands 25-ton preforming load.

SPECIFICATIONS No. 20 and No. 45

	Model No. 20	Model No. 45
Pressure applied to punch at 60 strokes per minute (see note below)	75-ton	200-ton
RECTANGULAR DIES		
Maximum area of tablet	9 sq. in.	28 sq. in.
Size of Die	4" x 7" x 2 1/16" thick	5" x 10" x 4" thick
Diameter of Preform	1 cavity 3"	2 cavities 4"
Maximum length of Preform	6"	8 1/2"
Maximum Rectangular area in which preform can be located	2 3/4" x 5 1/4"	3 1/2" x 8"
Maximum Rectangular area in which cores can be located	1 11/16" x 5 1/4"	2 3/4" x 7"
ROUND DIE (45 ONLY)		
Maximum area of tablet	.....	28 sq. in.
Size of Die	.....	8 1/2" dia.
Maximum diameter of Preform	.....	6" diameter
Maximum length of Preform	.....	7"
Maximum area in which preform can be located	.....	6" diameter
Maximum area in which cores can be located	.....	2 3/4" x 7"
Maximum depth of fill	2 3/16"	3 1/8"
Height—floor to top of die	51 3/4"	72 1/4"
Height—top of handwheel with head in high position	72 3/4"	110 1/2"
Height—top of Hopper (total height of machine)	80 1/4"	114"
Floor space required	63" long 37" wide	91" long 58" wide
Weight of machine with motor and variable speed drive	Net 5300 lbs. Gross 5700 lbs. Exp. 6400 lbs.	Net 14000 lbs. Gr. 14600 lbs. Exp. 15500 lbs.
Speed of machine in strokes per minute	30 to 60	20 to 60
Motor and variable speed (furnished)	5 H.P.	20 H.P.

TRANSFER MOLDING PRESSES

There's nothing like the new Defiance Transfer Presses! Designed by plastics engineers for the plastics industry . . . these new presses offer higher accuracy in production . . . lower die designing and construction costs . . . reduction of waste material . . . lower maintenance costs . . . and greater cleanliness. In the Defiance No. 152 Transfer Press a transfer pot and punch are *furnished with the press* . . . thus eliminating the necessity of designing these units with the die. Other pots and punches are available and easily changed. Ruggedly built with extra strength in vital parts. Overall die support reduces die distortion to minimum. Many other new advantages.

GENERAL PRESS SPECIFICATIONS No. 152

	No. 152		No. 152
Maximum working pressure	3000 lbs./sq. in.	Max. daylight between follower and floating platen die supports	21 in.
Diameter main ram	12 in.	Max. daylight between floating platen and head	5 in.
Die clamping pressure (at 3000 lbs./sq. in.)	170 tons	Sprue breaking pressure (at 3000 lbs./sq. in.)	3.7 tons
Diameter transfer cylinder	6 in.	Transfer ram return pressure (at 3000 lbs./sq. in.)	2.8 tons
Transfer pressure (at 3000 lbs./sq. in.)	42 tons	Follower pull down pressure (at 3000 lbs./sq. in.)	11.6 tons
Stroke of main ram, maximum	15 in.		
Stroke of transfer cylinder, max.	6 in.		
Die size, maximum—F. to B.	18 in.		
L. to R.	26 in.		
Head adjustment (2" increments)	8 in.		

TRANSFER POT SPECIFICATIONS

Transfer Pot Dia. Inches	Max. Transfer Pressure* Lbs./sq. in.	Max. Projected Die Area Sq. in.	Recommended Preform Dia. Inches	Capacity of Pot Material @ 0.6 oz./cu. in.
3 1/4	10,200	33	3	19 oz.
3 3/4	7,800	44	3 1/2	26 oz.
4 1/4	6,000	57	4	34 oz.
4 3/4	4,800	71	4 1/2	43 oz.

* Line pressure 3000 lbs./sq. in.

Write for new bulletins.

DEFIANCE MACHINE WORKS, INC.

DEFIANCE, OHIO, U. S. A.

Backed by 95 Years of Precision Manufacture

Thermatron

PROVIDES MORE HEAT...FASTER... PER DOLLAR

The amazing results obtained with Thermatronic heating are revolutionizing production methods in a wide number of diversified industries for the simple reason that it does the job better, faster and at lower cost.

APPLICATIONS OF THERMATRONIC HEATING...

- Curing rubber and tobacco
- Deactivating enzymes
- Defrosting frozen foods
- Dehydrating
- Drying paper and textiles
- Distilling
- Destroying grain infestations
- Fabricating thermoplastic materials
- Impregnating wood
- Manufacturing drugs and chemicals
- Manufacturing plywood
- Pasteurizing milk and beer
- Preheating plastics and rubber
- Polymerizing resin
- Sealing or Bonding Thermo Plastic products
- Seasoning lumber
- Sterilizing

SEALING...WELDING...BONDING

Radio Receptor Co., Inc., pioneer in the field, has developed three power packed models — the Heatmaster, Heatmaster, Jr. and Weldmaster, to meet the exacting demands of industry from laboratory research to the processing of all types of Thermoplastic products, including shower curtains, tobacco pouches, rain coats, and many others.

Check these eleven advantages of Thermatron: electrodes designed for your specific requirements . . . heating units at working level . . . automatic control for unskilled operators . . . mobile, compact units . . . complete overload protection . . . automatic cooling . . . safety switches protect unskilled operators . . . all parts accessible for inspection and maintenance . . . adjustable self-levelling upper electrode . . . visible, fluorescent lighted work chamber . . . guaranteed components.

RADIO RECEPTOR COMPANY, INC.

Since 1922 in Radio and Electronics

251 WEST 19th STREET NEW YORK 11, N. Y.

Write for your copy of "Electronic Heating With the Thermatron," our new booklet, describing how to make use of this new powerful electronic force to lower costs, to speed production, to develop new products — a comprehensive, practical guide to the application of electronic dielectric heating.

Visit our booth number 259 at the S.P.I. plastics show, Grand Central Palace, April 22 to 27.

MOLDINGS AS LARGE AS THE HULL OF A BOAT ... FROM A SINGLE BASIC PIECE of CO-RO-LITE

the Rope Fibre Plastic

The use of CO-RO-LITE enabled famous yacht designer Olin Stephens to turn out a trim seventeen-footer whose hull was ribless — yet strong; built up in a series of compound curves for greater speed and safety — yet inexpensive to produce.

● There's real economy in the use of CO-RO-LITE—economy achieved through pre-forming, which eliminates lay-up—and through the speed of curing. A single piece of CO-RO-LITE is readily pre-formed and molded into compound curves, deep draws, angles, channels, and large shells.

CO-RO-LITE, the rope fibre plastic, is a ready-to-mold thermo-setting plastic compound. It is equally effective with fluid pressure, high pressure, flash, or transfer molds. Long, tough, interlocking rope fibres reenforce all sections of the molded unit, imparting great impact, flexural, compressive, and tensile strength in a range of densities comparable to wood.

In production, it is estimated that this aluminum mold and the large autoclave in the rear can produce these hulls in two hours each, plus twenty minutes for curing!

CO-RO-LITE: — Rope fibres impregnated with thermo-responsive resin: — Product and process patented — Patents No. 2,249,888 and No. 2,372,433 — other patents pending.

ARMY E NAVY

COLUMBIAN ROPE COMPANY

ALLIED PRODUCTS DIVISION

500-92 GENESEE ST., AUBURN, "The Cordage City", N. Y.

Canadian Licensee, Canadian Bridge Engineering Company, Ltd., Box 157, Walkerville, Ontario, Canada

LIKE EGYPT'S GIFTS, STERLING COMBS . . .

Possess the qualities that attract and endure! They parallel, in thought, the underlying principle of the Sphinx . . . excellence of craftsmanship, unhurried to perfection. STERLING Combs, by their exquisite modern design, new beauty and smooth brilliance, pay tribute, too, to their Queen—American womanhood. We might even go so far as to hazard the thought, that, at the peak of their glory, Egypt's Queens would have cherished the chance to exchange their priceless jewels and expensive serrated bone combs for one as lovely and hair-perfect as today's popularly priced STERLING. This might also have applied to the barter-conscious Pharoahs, for STERLING Combs are also designed for men!

STERLING PLASTICS COMPANY

Manufacturers of Sterling, Serene & Glider Combs

COMMERCE AVENUE, UNION, N. J.

No. 385

STERLING DRESSING COMB . . . 8½" LENGTH

for beauty and distinctiveness . . .

leading designers specify "Trim by **GRIGOLEIT**"

Yes, Grigoleit is the molder selected by many nationally-prominent manufacturers of styled products. For beauty . . . for design . . for sales appeal . . . for quality . . . for service, Grigoleit has been a dependable source for 19 years.

For reasonably early availability, we offer an extensive "standard" line of handles, knobs and other parts for stoves, furniture and household appliances; also a large "stock" line of closures for foods, drugs and cosmetics.

We also maintain a complete custom-molding service in thermo-plastic and thermo-setting plastics. Operating our own metal and tool shops, we are able to insure perfect blending of plastics and metal.

Write for 1946 Catalog

THE GRIGOLEIT COMPANY

DECATUR 80, ILLINOIS

WATERTOWN
Molders of skill and experience
for over thirty years
COMPRESSION • INJECTION • TRANSFER
All Thermoplastic and Thermosetting
Materials Molded
ENGINEERING • MOLD MAKING
BUFFING • FINISHING • ASSEMBLY
Watertown
A NAME AS OLD AS THE PLASTICS INDUSTRY

TAYLOR FIBRE COMPANY

Manufacturers of Vulcanized Fibre, Phenol Fibre, Taylor Insulation, Taylor Silent Gears

NORRISTOWN, PENNSYLVANIA

CHICAGO 6, ILL., 11 S. Desplaines St.
CLEVELAND, OHIO, 1213 W. 3rd Street
DETROIT 2, MICH., 6432 Cass Avenue
MILWAUKEE, WIS., 312 E. Wisconsin Ave.
NEW YORK CITY 6, N. Y., 90 West St.
PITTSBURGH, PA., First Avenue & Ferry St.
ROCHESTER 4, NEW YORK, 82 St. Paul St.
SAN FRANCISCO, CAL., 554 Bryant Avenue

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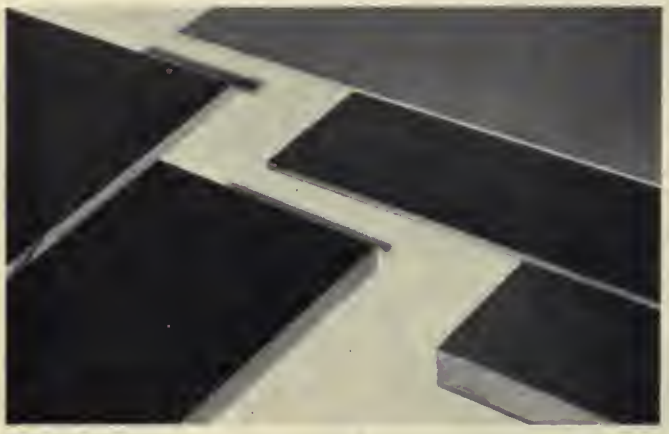
SEATTLE, WASH., 1016 First Avenue
ST. LOUIS, MO., 2127 Pine Street
ST. PAUL 4, MINN., 2429 University Ave.
TOLLAND, CONN.
TORONTO, ONT., Cambridge Street Etobicoke



TAYLOR VULCANIZED FIBRE

TAYLOR Fibre is an exceptionally high-grade vulcanized fibre, produced with particular attention to the specific requirements of fibre users for convenience and economy in fabrication, and for great mechanical strength and high insulating qualities.

The superior properties of this vulcanized fibre are due to the modern methods of manufacture which are employed in a new, up-to-the-minute plant where specially designed machinery, highly refined raw materials, sparkling clear artesian well water and corrosion-resisting equipment and piping throughout, produce the "cleanest" sheet of fibre that can be procured.

Taylor Vulcanized Fibre is offered in all standard colors and in thicknesses from .005 inch to 2 inches.

Taylor Fibre sheets over 3/8" and up to 2 inches in thickness are supplied in a special waterproof grade which has general qualities of both vulcanized fibre and phenol fibre. Prices of this fibre are the same as the regular vulcanized fibre list.

TAYLOR PHENOL FIBRE

Taylor Phenol Fibre is a phenolic resin—impregnated paper or fabric formed with heat under hydraulic pressure into sheets of high dielectric strength, great physical strength, low moisture absorption, unaffected by heat or cold (excepting extremely high temperatures) and resistant to oil and most chemicals.

Because this material is readily machined, it is adaptable to modern high speed production methods. It answers the specifications of a majority of insulating problems with properties which in many cases exceed N.E.M.A. standards. Made in all standard thicknesses from .005 to 9" and standard colors.

TAYLOR INSULATION (Fish Paper)

Taylor Insulation, made by the same improved methods and equipment as Taylor Vulcanized Fibre, possesses the same superior mechanical and dielectric properties. Taylor insulation is supplied in all practical thicknesses and in either sheets (56" × 90") or continuous rolls (56" wide). A new standard for armature insulation and other electrical work where a thin, extremely flexible yet strong insulation of high efficiency is required.

TAYLOR SILENT GEARS

Taylor silent gear blank stock is a highly resilient, wear-resisting phenol fabric of great strength and durability. It quiets noisy metal-to-metal contacts in the gear trains of many types of machines. Taylor silent gears absorb shocks, save wear, reduce the hazard of breakdowns and costly production delays, save maintenance expense, improve the quiet operation and lengthen the life of not only the gear trains but the machine themselves. Taylor Silent Gear material, made from a woven fabric impregnated with phenolic resin and formed under high pressure into an extremely dense substance, withstands contact with chemicals, dust, dirt, grit, grease, oil and rodents.

It may be accurately and easily machined and being less affected by heat and cold than even metal itself, it remains accurate on the job.

Cell and Cover of "Moisture Meter" Compression Molded for C. J. Tagliabue Mfg. Co. Brooklyn, N. Y.

What is the Moisture Content of Given Samples?

This Plastic Cell Assists in the Determination of Correct Answers

This cell and cover are functional parts to a piece of equipment thot records the omount of moisture present in selected specimens such os soop, flour, dehydroted foods, etc.

Were you to look ot these two compression molded parts with a molder's eyes, you would see, as we see, o beouty thot is more thon skin deep; in fact, the cell section is exceedingly deep . . . 5¼" — ond extremely norrow . . . 1". The inside covity surfoce is smooth, flowlessly squared. Side and bottom woll thicknesses ore uniform, rigid, dimensionolly true (no worp!). The carefully designed cover sets tightly in ploce . . . o perfect stroight-to-the-line fit!

The rugged mold construction colled for the molder's best . . . ond we gove it plenty! If you could study the ports and catch the gleom of their brilliant, molded-in finish, you'd certoinly share our molder's love for them.

In detoiling this porticulor ochievement, we, of Consolidoted, hove in mind that the completeness of our facilities moy be helpful to others with similor problems. The opportunity to serve you is cordially solicited. Inquiries invited!

COMPRESSION
INJECTION
TRANSFER

CMP
"YOUR BLUEPRINT IN PLASTIC"

Consolidated
MOLDED PRODUCTS *Corporation*
309 CHERRY STREET, SCRANTON 2, PA.

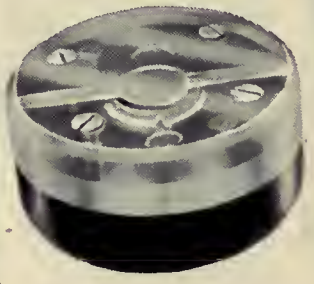
Branches: NEW YORK • CHICAGO • DETROIT BRIDGEPORT • CLEVELAND

complete plastic production...

all under one roof

CASE HISTORY No. 1

This Bakelite and Polystyrene assembly was produced as part of the now-famous proximity fuse. Designed to close tolerances, this complex little job employed a combination of Printloid's extensive facilities. It was designed, milled, drilled, tapped, cut, shaped, sanded, polished and assembled, "all under one roof."

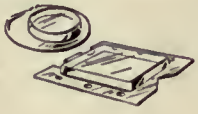


Printloid is a four-in-one outfit that brings you complete plastic fabrication in one plant. Experts handle your job from the initial design through final assembly.

Results? No shopping around, no wasted time. Instead, better design, uniform control and lower costs with Printloid engineering supervision at every step of the job.

FORMING

Radio Dial windows are a Printloid specialty, and we have made millions for the country's largest radio manufacturers. Printloid has worked for every industry, producing finished products as well as sub-assemblies.



PRINTING AND DIE CUTTING

Limitless possibilities of printing, from line cuts to four color process printing, are yours at Printloid. Die Cutting facilities range from steel rule dies to hydraulic presses for heavy plastic sheets.

MACHINING

Printloid is experienced in precision work to .001" in all machining and finishing operations. Typical of our complete facilities is 2½ inch through spindle lathe capacity for machining.

DESIGN AND ASSEMBLY

Printloid experts work to your specifications or execute your original designs. Displays have been created for leading national advertisers. Our engineers invite you to consult them on your problems.

PRINTLOID, INC.

Dept. P, 93 Mercer Street, New York 12, New York

The new Printloid catalog tells the story of complete plastic production under one roof. Includes a useful Plastics Glossary. Write for your copy.

Printloid INC.
PLASTIC FABRICATION

Beauty and Utility

IN PLASTICS *and* METALS

Important to all designers is the fact that plastics, metals, and plastic-metal combinations are being produced entirely under one roof by the Bay Manufacturing Division of Auto-Lite. Such examples as this Fifth Avenue Medallion, a finely designed plastic casting mounted on a chrome-plated and decorative bezel . . . the vinylite plastic grommet and nipples (vinylite does not require the heavy walls of rubber products) . . . the etched enamel-filled high polished chrome escutcheon . . . typify fine Auto-Lite craftsmanship.

THE ELECTRIC AUTO-LITE COMPANY

Detroit 2, Mich. — *Bay Manufacturing Division* — Bay City, Mich.

UNDER ONE BIG ROOF AT . . .

Auto-Lite

Tune in the Auto-Lite Radio Show Starring Dick Haymes
Every Saturday Night, 8:00 P.M.—E.S.T. on CBS

BUY WAR BONDS

No museum pieces...

BUT DARN GOOD MOLDED PARTS...

We don't claim to be magicians,
Nor to set the world on fire,
We're just darn good custom molders
With sound experience for your hire.

We've been born and bred on plastics,
Produced millions of varied parts,
For home, and war, and industry.
We're skilled in all the molding arts.

We've the machines that do the trick,
The men who have the skill
And we have the bag of combinations
To fill most any custom bill.

We're producing better and faster
Than we ever did before.
And we're ready, willing, and able
To tackle the problem you lay at our door.

Our "Ready Reference for Plastics" is yours if it will help you buy or design plastic moldings.

BMD

ARMY E NAVY

BOONTON MOLDING COMPANY

MOLDERS, BY MOST ALL METHODS, OF MOST ALL PLASTICS

BOONTON · NEW JERSEY · Tel. Boonton 8-2020

NEW YORK OFFICE

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A new Beauty Combination . . .

PLEXIGLAS

and wood

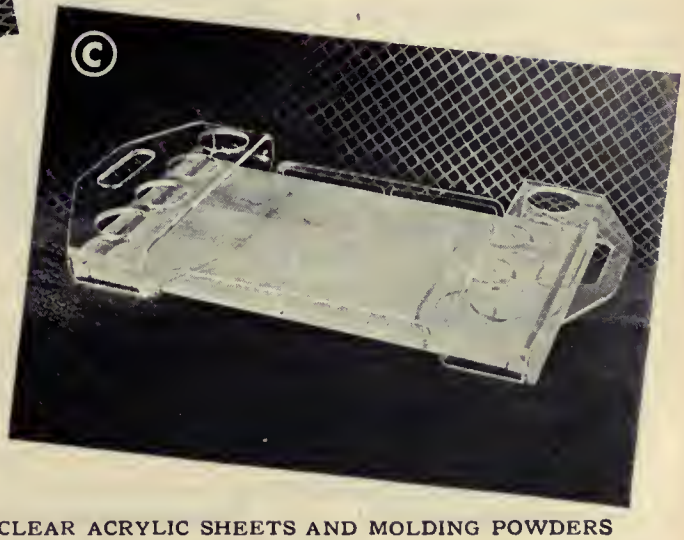
Here are two *natural* team-mates that win every time!

Designers, fabricators and molders find that PLEXIGLAS and wood are going places together because they complement each other so perfectly. The result: extra beauty, extra eye-appeal, extra *sales-appeal!*

Production of your own designs can be facilitated through the use of this interesting combination. PLEXIGLAS is easy to handle . . . makes items of the highest quality simple to produce in volume.

We'll be glad to give you technical assistance. Just call or write our nearest office: Philadelphia, Detroit, Los Angeles, Chicago, Cleveland, New York. Canadian Distributor: Hobbs Glass, Ltd., London, Ontario.

This tag identifies Plexiglas merchandise... tells the public at a glance that the product is made with the famed quality plastic they can depend on.



A The natural way in which PLEXIGLAS and wood go together is evident in this attractive magazine rack.

B Symmetrical curved ends of PLEXIGLAS join with polished sides of wood to make an unusual and eye-appealing wastebasket.

C In this serving tray, the combination of PLEXIGLAS and wood becomes a unique combination of beauty and utility.

These items were designed by Sundburg & Ferar of Detroit, Michigan . . . produced by Plastic Mfg. Co., Dallas, Texas.

ONLY ROHM & HAAS MAKES PLEXIGLAS CRYSTAL-CLEAR ACRYLIC SHEETS AND MOLDING POWDERS

PLEXIGLAS *is a trade-mark. Reg. U. S. Pat. Off.*

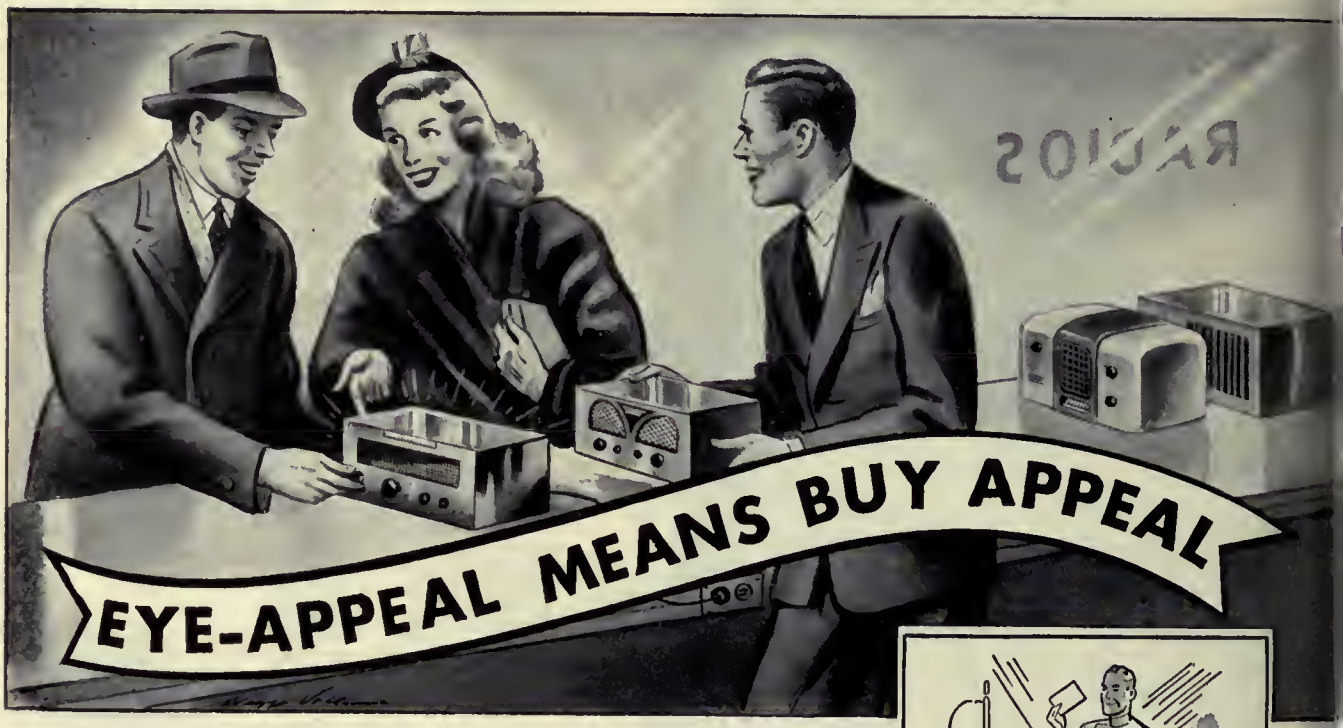
ROHM & HAAS COMPANY

WASHINGTON SQUARE, PHILADELPHIA, PA.

Manufacturers of Chemicals including Plastics . . . Synthetic Insecticides . . . Fungicides . . . Enzymes . . . Chemicals for the Leather, Textile and other Industries

Codur

. . . THE FINAL TOUCH OF PERFECTION THAT MAKES PLASTICS SELL FASTER!



Plastics look their best, and sell fastest, when they have the added surface beauty of a very fine finish like CODUR.

CODUR is a line of high-gloss, synthetic baking enamels especially designed for a one-spray coat application on molded (phenol formaldehyde) plastics. They have excellent color retention and bake to a very hard mar-resistant surface. CODUR is available in most colors in plain enamels and many metallic colors. M & W also offers air-drying or baking finishes for other plastics: acetates, butyrates, methacrylates and others.

SERVICE THROUGH RESEARCH AND EXPERIENCE

Whatever the material, simply submit a sample of your plastic and we'll recommend the proper finish. 70 years' experience and our fine research facilities are at your service. Contact any of our offices.

PIONEERS M.&W.Co 1876 IN PROTECTION

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p. 11 in a Series of Advertisements "MEET MEtal Plastic Engineering"

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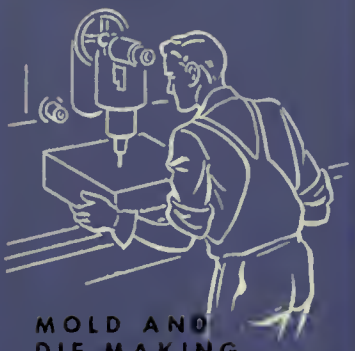

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Photo courtesy
Porker Stomp Works, Inc.,
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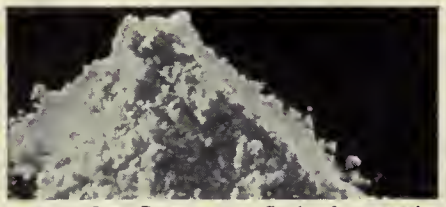

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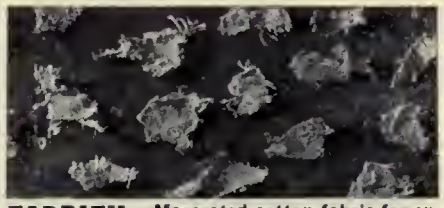

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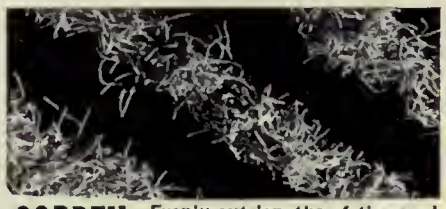

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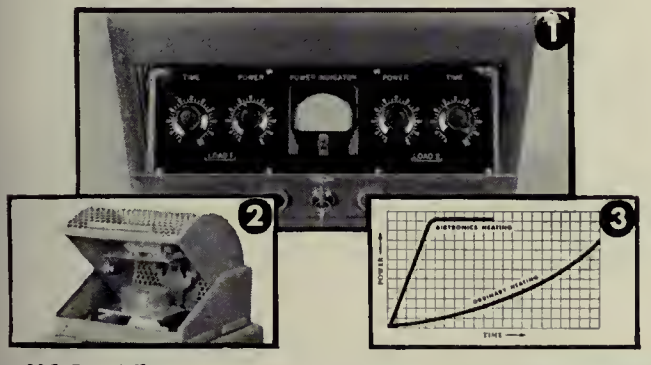

1 Dual Set-up Controls—Dual Set-up Controls permit independent adjustment of power output and heating time for two loads.

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*Reg. U.S. Pat. Office

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PLASTICS in PERSPECTIVE.....

THIS is the Second Annual Directory of ***plastics.*** The organization of the material obtained from thousands of questionnaires follows the general pattern established a year ago. The current Directory, however, contains, as an important new feature, a set of bar charts making accessible at a glance the comparative properties of the leading plastics for which data were available. Such data as comparative specific gravity, water absorption, or impact strength—and so on through twenty-one charts—are here made available in a matter of seconds.

This innovation in the bringing together of a great mass of scattered information in simple and highly usable form is expected to prove indispensable in the quick and efficient selection of materials for predetermined applications, and in avoiding the choice of the wrong material to perform a given job.

For the past six months, the plastics industry has been specifically occupied with—and plagued by—the problems of reconversion. In spite of this preoccupation, it has taken of its time to answer our questionnaires. Without this whole-hearted co-operation the collection and compilation of the material presented herein would not have been possible.

The year between the two Directory issues has been crammed with history-making events. History may place last March in the twilight of an era, this March at the beginning of a new. Tremendous new forces, mental as well as physical, are abroad in the world. It is a stimulating time in which to live. We believe that, with the trend of things and despite obstacles and discouragements, the year ahead will be the greatest ever in the plastics industry.

* * *

STARK tragedy stalks the country day after day as headlines report death by fire in blazing infernos of what just a few minutes before was somebody's home. Often that somebody lies dead in the smoldering embers, frequently burned beyond recognition. Almost inevitably the news reports, "the flames spread rapidly through the structure."

All too frequently children are burned to death. A soldier father in far away Japan lost all his children in a fire that destroyed his rural Michigan home. Parents lost their grown or nearly-grown daughters in a similar disaster near Chicago. Thirteen persons died in a fire that swept through an old people's home in Cleveland.

Such catastrophes are nationwide. Besides the appalling suffering and the incalculable loss in lives, millions of dollars worth of valuable property go up in smoke and flame each year.

What has this to do with plastics? Well, plastics could point the way to the development of non-flammable—or at least slow burning—housing materials at a price competitive with that of existing products. The secret of such materials may lie in the low-pressure laminates. To develop them and put them within the reach of the masses presents a real challenge and a real problem, the solution to which would be a blessing to mankind.

* * *

SPEAKING of laminates, the Low Pressure Industries Division of the SPI put on a successful convention and exhibit at Chicago early in February. Attendance numbered 238 registrants, a turn-out which a few years ago would have been a good attendance at a general SPI convention. Enthusiasm was rampant, but nowhere did one fail to find realization of the obstacles ahead: the development of continuous production techniques and reductions in cost.

At present it seems generally agreed that too much hand labor is required in the making of laminated objects. To solve this problem calls for toil and sweat in the industrial laboratories, free expenditure of money on experimentation, and a courageous application of new ideas. Success in the development of mass production techniques could well mean a tonnage consumption of plastics which would make present consumption look trivial.

The laminating industry has come a long way in the war years; it has a much longer and more difficult way in the peace years. To our mind, however, past accomplishment presages future success.

* * *

WHILE on the subject of conventions and shows, pleasure should be expressed at the reception accorded the Detroit exhibit sponsored by SPE. Between 10,000 and 15,000 people paid a dollar each to see the exhibit, and personal observation indicated that they got their money's worth. The interest of the public in plastics is quite gratifying.

* * *

AMONG the designs for tomorrow displayed by Egmont Arens, designer, before the Low Pressure Industries Division on February 2 was that of a house which, like the sunflower, turns with the sun, the object being to obtain maximum light and heat. Included among other designs looking toward the future were boats, toys, automobiles, and trains.

In introducing his designs, Mr. Arens spoke of the need of—and defended—the man who "sticks his neck out and then tries to catch up with it." We think he has something there. END

The Better the Cure...

The Better the Plastic Part!

ALL RIGHT—"better" is a loose word and we admit it. But Heatronic molding (utilizing radiofrequency preheating) gives you a cure with so many improvements that we couldn't cram 'em in *six* headlines. They're worth studying, though, so here they are — 13 direct results of Heatronic molding:

Increased—structural strength, dimensional stability, chemical resistance, dielectric strength, volume resistivity, density uniformity.

Decreased—shrinkage, warpage, finish defects, porosity, internal stress, dimensional variation and mold, pin, and insert breakage.

Plastic Pre-form in Heatronics Applicator

So, how about Heatronic treatment for *your* job? Where do you go for answers?

Why not come to the plastic molder who introduced Heatronics to plastic molding—who has accumulated an outstanding backlog of experience in its use—who's built up a whole battery of units to provide it? We'll be glad to help.

Kurz-Kasch service covers every aspect of plastic molding from design to finishing — the whole works, under one roof. Why not ask for a Kurz-Kasch engineer?

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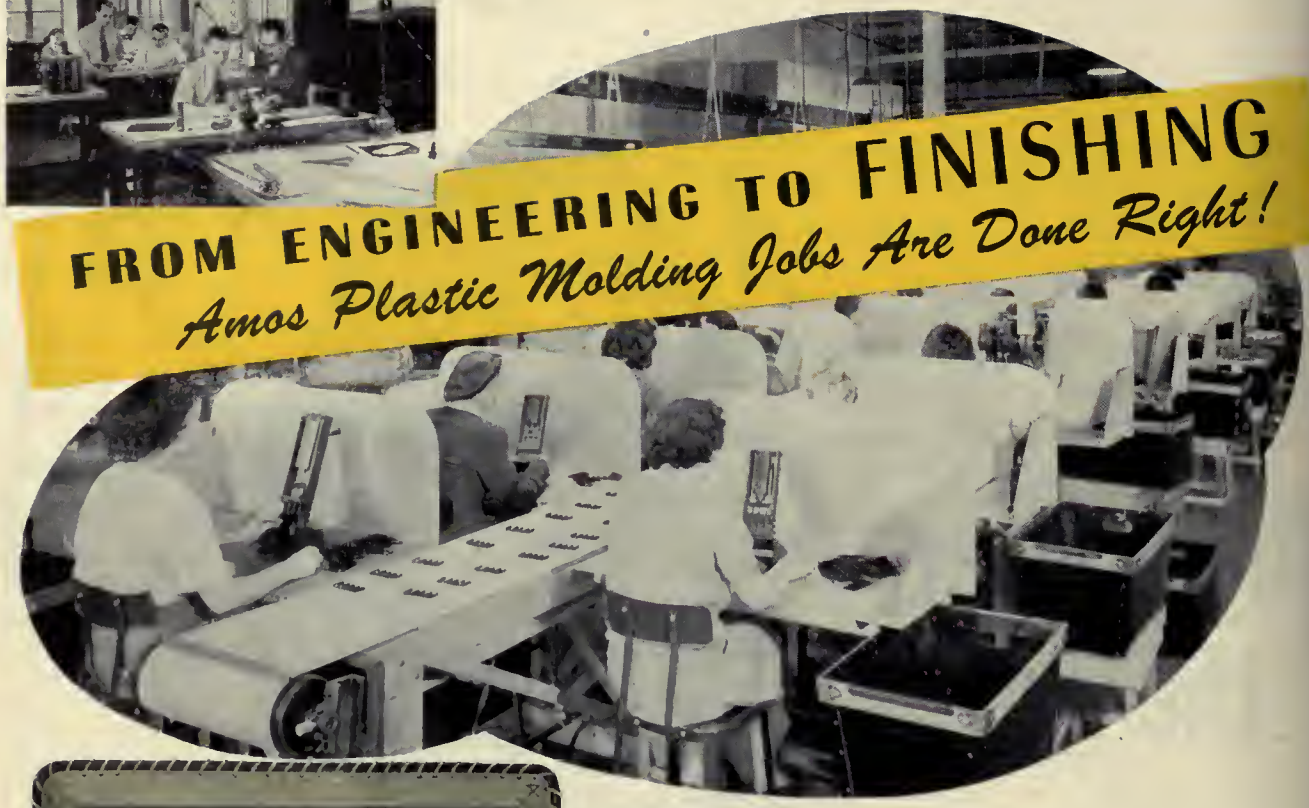

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Your job starts in the Amos engineering department . . . where a staff of broadly-experienced plastic engineers plan every production step the most practical way. They design the mold . . . build any needed fixtures . . . and see the job through . . . from materials to molding to finishing.

Many jobs require special assembly equipment and technique. One of these conveyor assembly lines in the Amos finishing room is shown above. It is typical of the modern and efficient facilities for the production of fine plastic parts and products in the new Amos plant.

Send us your drawings—or write us about the part or product you want molded in plastics.

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MOLDED PLASTICS...

CUSTOM *Molders of*

Plastic Parts and Products

Injection Molding Specialists

The Buyer Says: Plastics have what it takes in salability, beauty, colorability, light weight and other advantages to attract, sell and satisfy the consumer

By Kathleen Green Skelton

THIS survey was made during the frenzied seller's market of December, 1945, when demand outran supply in all merchandise, and the chief complaint of harassed buyers was that plastics were all too scarce. But although immediate worries centered around depleted inventories, the buying spree and the short supply were not expected to last indefinitely, and buyers were glad to talk of the long-range problems of their plastics merchandise.

How have consumer plastics stood up during the war, and how will they be affected by the much-heralded "return to metal"? Is there consumer prejudice against plastics? Based, it is said, on their experience with defective compacts and measuring spoons, the largest department store in Toronto displayed a suggestive placard, "All holiday purchases can be returned after Christmas *except* plastics." How representative is this attitude?

With these questions in mind, buyers were asked, not their opinion of plastics, but of individual articles sold on their counters. The criterion was purely a merchandising one: did the article sell well; was the price right; was it well-constructed; could you sell more if the price were lower? Specific criticisms, whether adverse or favorable, are offered here in the belief that they will be helpful to the industry.

Misapplications in the gadgets fields have been noisily bruited in the last year or two when plastics were requisitioned for war matériel, and after all the stern talks the industry has been giving itself, it was refreshing to find that buyers looked with enthusiasm on their plastics merchandise. Compared with other war goods, plastics had

Colorful and glamorous plastics also attracted crowds of humanity, such as this, which flocked to counters last December to set new purchasing records

Methyl methacrylate combines with glass to make a best selling highball tray. Guard rail and handles are turned in ¼" "Plexiglas" sheet, and a plate glass base with sand-blasted floral design fits into a groove in the guard rail

stood up well, and some of the misapplications of material which caused apprehension in the industry—the thermoplastic tea strainer, for instance—appear to have excited little antipathy in the public mind. Dissident voices were heard, to be sure, in the discussion of novelties and of compacts and lipsticks, for reasons which will be reviewed, but of the many buyers interviewed, only two or three felt that molders had dumped cheap merchandise on a get rich-quick policy during the war.

Though money was no object in the buying rush of the Christmas holidays, price was the most frequently mentioned objection to plastics. With but few exceptions such as jewelry, it was the chief objection to most of the merchandise surveyed; and without any exceptions syndicate buyers said that they could sell more plastics if the price were lower. Buyers in lower-priced stores expected to replace some plastics with metal *only* because they were not competitive in price. In more expensive stores, price was less of an object, of course, and in such stores complaints were on the score of quality and the fact that expensive merchandise had been sold them and duplicated in the chain stores at lower prices.

Strangely enough, another general ground of complaint was color, the quality in which plastics excel. Buyers complained that they could not get the colors they wanted, and were often forced to take an assortment. Axiomatic as it should be, the extent to which color is responsible for the sale of plastics appears not to have been fully realized, nor the fact that certain goods carry rather rigid color conventions. Such color conventions are changed only by advertising campaigns and not by casual sales of off-colors by molders. Revlon's notable color promotions stand out as anything but casual, and one Middle West department store is said to have spent $100,000 to promote its version of this spring's 'penny copper.'

Even before the war, molders, fabricators and buyers in turn were forced to take an assortment of colors, and one molder had had thirteen shades of ivory on hand at one time. It was frequently suggested that material suppliers should cut down their large color assortments, standardizing and stressing a few popular shades. Specialization on a few basic colors might also result in price reductions, and special colors could be supplied to the quality trade at higher price.

Although they were not numerous, difficulties also occurred through use of dimensionally unstable or water absorbent materials in applications subjected to heat and moisture. The majority of buyers did not know the material of which their merchandise was made, but distinctions were beginning to be drawn between the stability of different plastics. In some cases salesmen had given them a telescope account of the chemistry of plastics, resulting in a somewhat garbled picture; but other buyers were well-informed about plastics materials.

Faulty design was another cause of failure. Flimsy wall sections, use of the wrong adhesives, poor finishing (gate and weld marks, for instance), and poor polishing were common complaints. This, too, was attributable to the war and to the speed with which new products were designed and executed.

Throughout the war plastics scrap supplied the counters of the ten-cent stores with a luxury of color and charming design. Delicate shell-like flowers (cellulose acetate) in

This discussion is based on interviews with 61 buyers of plastics merchandise in kitchen, bath and wardrobe accessories, novelties, toys and toilet articles—the articles which an average housewife most frequently buys. Despite the advances of plastics in the industrial world, consumer goods still absorb a large volume of material. By one material supplier it was estimated that 50% of all thermoplastics went into these applications before the war, and one has only to look at the enormous volume of the ten-cent syndicates to appreciate the importance of the "gadget" trade.

Woven "Saran" monofilaments make a waterproof, velvety smooth, easily cleaned, highly rot-resistant clothesline

Metal screening is molded into the "Styron" rim to form a handsome, well-designed strainer at chain store prices

ranslucent pastels made pins, brooches, earrings; polystyene jewels gleamed in the proudest ears; transparent methyl methacrylate made shining monograms and brooches, while plastic pearls enhanced the traditional color scope of the oyster. The brilliant contribution of plastics toward maintaining feminine gayety and morale during the dark days of 1943 has, indeed, never been estimated.

Two years ago, syndicate buyers estimated that plastics supplied 80% of their jewelry, but this year, in the renascence of metal, plastics jewelry had all but disappeared, and only plastics pearls continued in quantity. Will plastics jewelry decline permanently in use now that metal has appeared?

Syndicate buyers said an emphatic no. Although the public is starved for metal at the moment, plastics will always be sold, particularly for spring and summer, because of their color and translucence. Such criticism as there was, was directed toward color; reds and whites, two important jewelry colors, had been poor the last year or two, and some firms had pushed color assortments.

Plastics had developed many new and beautiful effects in jewelry. Universally admired by buyers was the silver and gold-plated cellulose acetate jewelry. "Metallized plastic," as it is called, is capable of more complicated shapes and of more depth and undercuts in the mold than metal. It is also very much lighter to wear—an important feature in a large brooch or belt buckle. Gold and silver-plated plastics jewelry was in good demand this year in department stores as well as ten-cent stores, where it ranged from 59¢ for a small brooch to $1 for a large one set with plastics stones.

Buyers felt, too, that great credit should be given to such manufacturers as the Standard Plastics Co., Colt's Patent Firearms Mfg. Co., and the Maurice A. Lichten Co., who pioneered in the development of methyl methacrylate and polystyrene stones. These stones replaced Czecho-Slovakian cut glass stones so successfully that few could distinguish them, and at a competitive price. When the imported stones do reappear, transportation and inflation costs may make them considerably more expensive than plastics stones.

Though department stores showed little plastics jewelry, the maxim "Anything sells that's new" remained true even among this year's metal-starved customers, and Macy's showed a whole counter of milky white, translucent moonstone brooches in the form of bows, etc. selling at $1.83 and $3.67.

Methyl Methacrylate Novelties

Cigarette boxes and cases, trays, mirrors, frames, lamps and miscellaneous items appear in many departments of a large store, being variously classified as Notions, Toilet Goods, Stationery and even Housewares.

Scrap from bomber noses popularized many of these novelties during the war, and there was a good supply of them this Christmas in moderate-priced and expensive stores. Because of their prohibitive price, syndicates carried few items. Price, indeed, was a general complaint, and from Fifth Avenue to Woolworth's certain slow-moving articles were being marked down; on Fifth Avenue it was $25 vanity cases and dresser sets, while in Woolworth's it was a $2 cigarette box that was being closed out for $1.

Price, however, was not the only reason for the slow sale of certain novelties. Innovation is an important factor in this merchandise, and older styles quickly become a drug on the market, even when not duplicated in cheaper lines. In specialty shops particularly, novelty and uniqueness are the first criteria and such unusual items as a $7 shoehorn (sheet fabricated) were found, and $42 liqueur set, consisting of a case about 18″ by 5″ containing eight ordinary quality liqueur glasses.

Adhesives, too, were a common failure in the novelty field, the new vinyl type adhesives not having been available until recently, and many buyers were convinced that there was "no such thing as a foolproof adhesive in plastics."

Poor design, too, deviled the novelty market. Many novelties had been designed with too small gluing surfaces or with poor hinges and inadequate pins in the hinges.

All of these failures—price, design and adhesives—were

Cowboys, Indians, lassoes and tomahawks return to shelves long populated by khaki-clad GI's and instruments of war

New compact, molded by Allied Plastics from methyl methacrylate, comes in twelve designs, one for each Zodiac sign

embraced in such slow-moving items as lamps, which ofte occasioned comment on "the poor engineering of plastics. Even the cheapest of them, the small pin-up lamp retailin for $6 and up, had not sold well. Larger lamp bases c methyl methacrylate had been found "tippy," and it wa said that the material was too lightweight for lamps. (Suc bases should, of course, have been loaded.)

Other novelties, however, had been good sellers. Shee fabricated frames retailing in ten-cent stores for 29¢ t $2.50, though at present slow-moving, had been extremel popular during the war. New molded frames and eas frames were being introduced, and were expected to se well. Molded frames in polystyrene and cellulose acetat had an advantage in cheaper price; ten-cent store buye felt that $1 should be about top price for their frames a the $2.50 sheet frames (a double frame about 8″ high) ha always been slow.

For the same reason methyl methacrylate mirrors whic had sold as high as $3 and even $5 in a Fifth Avenue te cent store had been cleared. As the girls behind the cou ter put it, "People go to a department store to spend $5. In department stores mirrors were sold both separatel and in three-piece dresser sets, from $6 (for a molded set to $30, and they were said to be good seasonal items.

Trays of all types were among the best-selling noveltie cosmetic trays retailing from $2 to $15, while serving tra 15″ or 16″ long ranged from $7 to $30. In the constructio of these trays a combination of glass and methyl methacry late had been found ideal in reducing cost and enhancin their beauty. Though occasional trays were entirely co structed of methyl methacrylate, the majority of them us plate glass for the base and methyl methacrylate sheet f non-breakable handles and guard rail.

Cigarette boxes at $4 to $10 sold well as gifts, but pri was a general complaint. More expensive boxes, such a the grand piano music box, sold up to $20, but such expe sive novelties readily attracted copies, and the grand pia was being duplicated without music box and with less deta in the cutting of the legs for $8. Card boxes at $6 to $2 powder boxes at $5 to $12, and coaster sets at $3 to 10 we only fair sellers.

Kitchenware

In kitchenware military allocation of plastics forced th use of less stable materials in articles previously made urea, cast phenolics or melamine. Yet, though there we a few lines which buyers wished to replace with metal, pri was often a more serious ground of complaint than dime sional stability. Such plastics strainers, measuring spoon iced-tea spoons, salad sets, cheese graters, etc. as kept withi the 15¢ and 25¢ range usually sold well regardless of occ sional warping, because of their color and the fact that fe 15¢ items in any material are foolproof.

Funnels, colanders and knives for fruit, etc. were mo doubtful utensils functionally, and were not expected to l continued. A six-inch thermoplastic fruit knife sold for 5 in Macy's basement. Sink strainers had sold well, despi some warping, and buyers felt they would continue to se *if* the price were competitive. Present prices ranged fro 20¢ to 39¢ in ten-cent stores to 75¢ in department store For chain stores, buyers felt that strainers should ke within the 25¢ price range of metal; a sturdy well-ma metal strainer with rubber feet was already on the mark at 25¢ and buyers expected the advent of a 15¢ one.

Prices varied considerably on other articles on the "g gets" table now maintained in most department stores, a price was frequently no indication of quality, even in fiel where plastics have long excelled, such as caps and closure Complaints were often made about glass salt cellars, f example, because of their plastics caps; yet well-ma cellars priced at two for 5¢ had good caps with thick w

Tenite Over Steel

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Tenite-coated hand rail (the "RUB-BUB stanchion"), manufactured by Samuel Moore & Company, Kent, Ohio, from tubing coated by Carter Products Corp. of Cleveland.

Tenite

AN EASTMAN PLASTIC

Plastics, metal in combination introduce the new Cloud Silk matching lipstick and compact. The lipstick combines a gold brass base with a pagoda-like phenolic cap. The compact, of black painted metal, has a red phenolic cap

German metallized plastics toy searchlight, only about 2⅜" long and a little less than ½" wide, is notable for the exquisite precision of the molding job and the fidelity to detail shown. Now in an SPI exhibit, the little toy was brought to America by Capt. G. S. Nalle

sections and three threads, while cellars priced at 5¢ each and at 25¢ a pair had caps with thin wall sections and one-thread screws.

Pre-war cast phenolic-handled knives and forks were remembered by buyers everywhere, and were hailed as they began to trickle back onto the counters at prices from 20¢ up (in ten-cent stores). From Rye Beach to Harlem they had sold well, gracing the best dinner tables of the land, and had long since graduated into the ranks of staple merchandise. Acetate-handled knives and forks were just making their appearance, and were selling well. Preferred colors in both were red and ivory.

Pre-war baby and picnic dishes (urea and melamine) were being welcomed back. Charming Hemeoware baby bowls and cups had reappeared as well as some by the Watertown Mfg. Co. in pink and blue. Such baby dishes sold in various sizes from 25¢ to 59¢ in chain stores. Watertown had introduced its melamine picnic dishes in new Mexican colors, gay and brilliant. Both baby and picnic dishes were said to be always "good merchandise and good sellers."

Preferred colors in kitchenware (excepting, of course, baby dishes) were opaque red, white and ivory, and green. Transparent colors had proved unsuccessful.

Like kitchenware, bath accessories had suffered from the material scarcities of the war, and there were complaints of splitting and warping and of the difficulty of cleaning the material.

Tumblers were still scarce, buyers reported, but they appeared in various materials—cellulose acetate, cellulose acetate butyrate, polystyrene, urea, melamine. Hand-painted tumblers were a feature this year, selling from 25¢ to 50¢. Some beautifully finished and well-designed tumblers in urea and melamine appeared from the Bryant Electric Co. and the Northern Industrial Company.

In tumblers also price was no indication of quality, and flimsy tumblers with mere blobs for floral designs sold at the same price as well-made ones. A buyer in one large ten-cent store where poorly finished tumblers in transparent colors were on sale, said, "Our bathroom tumblers are a disgrace to the plastics industry."

Transparent colors did not sell in bath goods (except in more expensive towel racks and fixtures), and most-wanted opaque colors were white, green, red, and mixtures of black and white.

Space does not permit a discussion of wardrobe acces-

BIG SHOT!

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PLASTICS DIVISION
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sorics—boxcs, hatstands, coathangers, shoe racks, tie racks, etc., which, though popular, were too expensive to be fast selling. Acetatc film boxes ranging in pricc from $1.69 for a trinket box to $19 for a blanket box, were beginning to be duplicated in cheaper lines, as were coathangers and sueh gadgets as tic racks, which had sold in specialty shops for as mueh as $12.

Volumes might be writtcn about the non-functional and purely imaginative design of the early plastics coathangers. Fortunately, the newer models at 69¢ to $1 are much more functional than their early countcrparts at $2. Considerable price cutting has oecurred, and both the ten-cent syndicates canvassed had coathangcrs within the 25¢ range. Materials used were cellulose acetate, polystyrene and methyl methacrylate, and transparent colors werc *de rigueur.*

Toys

Toys are a large volume field in which plastics competc most successfully in whatever material. Buyers had only praise for their plastics toys and regret for their seareity. All stores at Christmas featured doll dishes and furniture, trucks, jeeps, ships, planes and telcphones until they ran out of them. Doll dishes, ranging in price from $1 to $5, which were prcviously the largest seasonal dollar volume itcm, had been supcrseded this year by thc new $2 telephone, a best seller in tcn-cent and dcpartment stores alike. Though the telephone was thc largest dollar volumc item, revolvers, planes. ships, jeeps, trueks, etc. ran into a larger volume of material. A new best sellcr on the Christmas market was Banner Plastie Co.'s oil truek.

Buyers pointed out that plastics jeeps, trucks, etc. had finer detail and more prccision in the molding than similar metal counterparts, and the new oil truck was exhibited as an example of an cxceptionally smooth job. At the same time, syndieate buyers cxpccted to replace certain toys with metal *unless* the price came down. A new metal truck at 25¢ was said to be better value than its plastics complement at 35¢. Some price cutting had already occurred in revolvers and other toys, leading buyers to think that initial costs and mold eosts had been far too high.

Good colors had been diffieult to obtain. Red, blue and green remained the first three ehoices in children's toys, while pink and blue were still the convention for infants' toys.

Lipsticks

Much has becn written and many gloomy prophecies made of latc on the score of plastics lipsticks and thc eagerness with which cosmetic manufacturers hail returning metal. The passing of the all-plastics case is freely predicted. Why this should bc a cause of distress to the industry is rather obscure; yet sinee it is a matter of foreboding to some, we are happy to rcport that the all-plastics lipstick ease clicitcd far less complaint from thc consumer than from the manufacturer.

Whether the all-plastics lipstick case will eventually "return," we leave it to wiser seers with handier crystals to determine, but a fact which sccms to havc been overlooked is that it has not, as yct, made its cxit—thc present scarcity of the metal lipstick being, indeed, its most stylish feature.

Before the war when both plastics and metal werc plenti ful, the trend was toward a combination of the two; and many of the manufacturers who arc reportedly turning to mctal are actually only returning to prc-war models of plastics and metal in combination. Pictured arc somc prc-war best sellcrs in metal and plastics which are again in production and soon to bc featured. Other cascs illustratcd arc: Gouricllí's luxurious all-plastics case molded of cellulose aeetate with a metal lining, a new lipstick in brass and

(*Continued on page* 305)

Metal and plastics again join to form the attractive, smooth-working lipstick containers shown in center. Shaving brush has a molded, shining, many-faceted acrylic handle. A piece of Chinese jade inspired design of the smart case for powder foundation

A few of the many small plastic items made in great quantities by Owens-Illinois.

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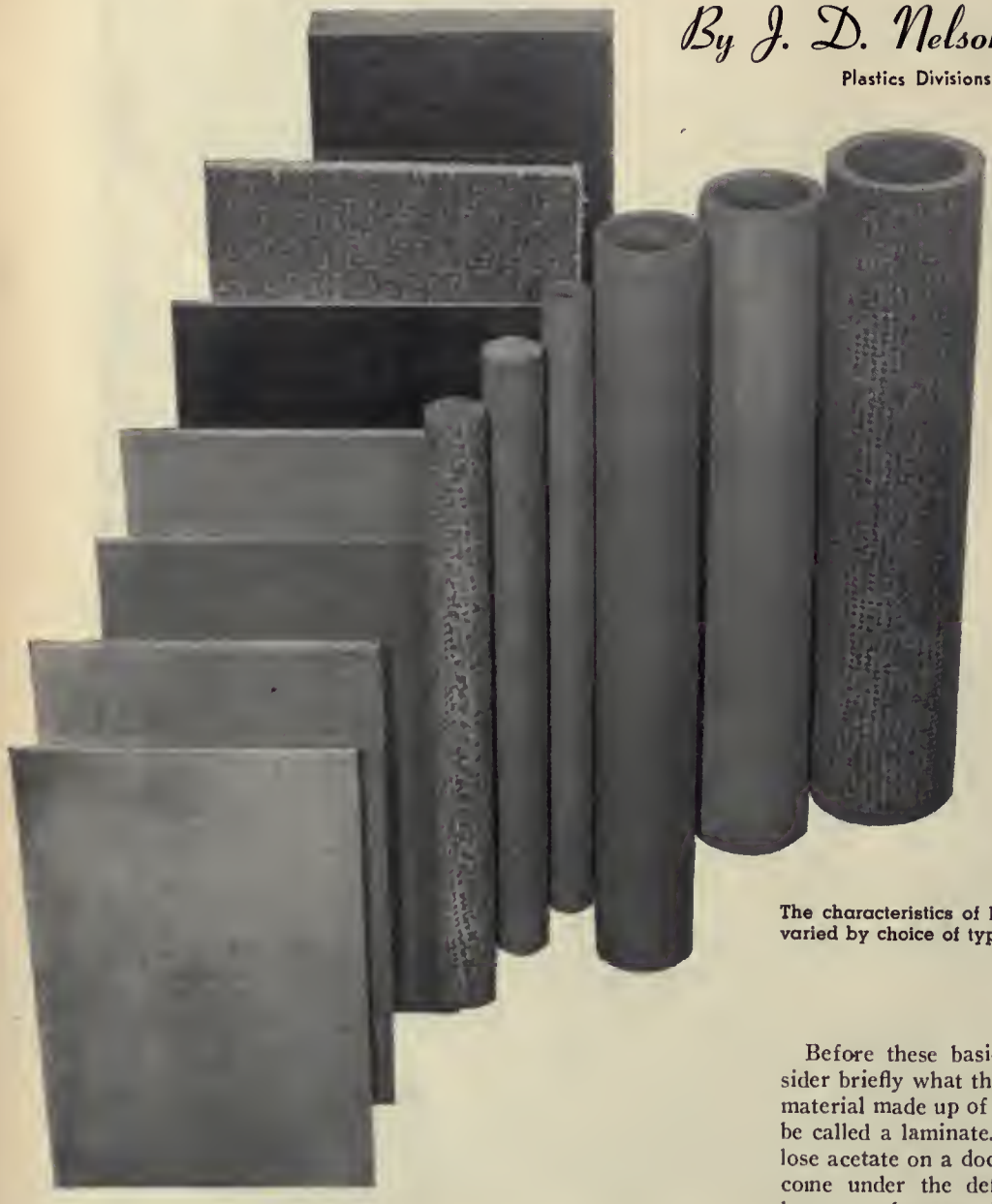
What the Laminates Offer

By J. D. Nelson and L. V. Larsen
Plastics Divisions, General Electric Company



When choosing th material for tha product you expe to start making, would be wise t give a thoughl to the laminate

The characteristics of laminated forms can be varied by choice of type and make-up of filler

WE ARE assuming, in this article, that the reader is a comparatively recent end-user of plastics and that, theoretically, he has a product he wants to have manufactured and is considering which of the plastics materials and processes is best suited to turn it out. Most newcomers have heard a good deal about molding because that is, inevitably, the process which comes to mind when one thinks of plastics. The end-user has also heard much of the machinability of the various plastics, which naturally suggests fabricated products. The chances are that he knows least about a third great division of the plastics family—the laminates—despite the fact that they had achieved a kind of classic status even before molding came into its own. This article is therefore an attempt to point out what kind of products call for a consideration of the laminates as a possible choice of material, and what service the laminator can offer a potential customer.

Before these basic questions are answered, let us co sider briefly what the laminates are. In a broad sense, a material made up of layers bonded by a synthetic resin m be called a laminate. Thus, an overlay of a sheet of cel lose acetate on a document, or of paper on plywood, wo come under the definition. In such cases, the separ layers can be seen. In a narrower sense, however, the la inates are a class of materials made of stacks of res impregnated paper, cloth or other filler subjected to h and pressure so that the components lose their identi emerging from the hydraulic press as a hard, comp homogeneous material. It is largely with these high pr sure laminates that this article will deal, though the l pressure laminates will also be referred to.

The first resin used for laminating was phenol formal hyde, which still remains of major importance, whetl used alone or modified with phenol furfural, aniline f maldehyde, etc. Melamine formaldehyde has made stri in the laminate field, and the silicones are also coming alo as binders. Fillers include paper and cloth of various grad sisal and other fibers, *Fiberglas,* asbestos and (recentl nylon.

One of the chief reasons why the high pressure lamina are less widely known than molded products by the gene public is that they are not the glamor girls of the indus but the lads in overalls. In plainer words, they found th employment in utility products for industry rather than

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Laminates make good calibrated instruments, nameplates, signs, decorative table and bar tops and wall paneling

products for the consumer. But with the advent of decorative laminates for table-tops, cabinets and the like, that is no longer true. But the strictly utilitarian applications are still the outstanding features of the laminates, and we discuss them first for that reason.

The first condition which should make an end-user think of laminates as the material for his product is when it has a large, essentially flat area. There are very sharp limitations on molding such an area since the whole piece is perpendicular to the line of application of pressure; and it is expensive. However, laminates "dished" in shallow curves (as in a serving tray) can be had as large as 20″ by 30″. Such large forms have been made for the inner doors of refrigerators, dished to a depth of 1″ and 3/32″ thick, and they have all the strength and rigidity of a small piece.

Another important application of the material in large areas is in switchboard panels, especially where they are subject to constant vibration. Here the high flexural strength of the laminates stands them in good stead.

A second general condition favoring the laminates is that in which high mechanical strength in relation to weight is called for. In this property the fabric-base type excels, so that it is used extensively for pulleys and gears. Laminated gears are not only noiseless, but also have great strength—an impact strength, for example, of 6 ft lb per inch of notch. Other items which have proved their value are clutch cones

Strong, lightweight molded-laminated casters, durable and shock resistant, give unmatched service

and discs, tubes (on which coils are wound), bearings for steel mills and ships as well as for scooters and wagons for the small fry of the family, large caster wheels for hand trucks, refrigerator door strips and graphited self-lubricating bearings for meters, instruments and business machines. Laminates are used not only for their strength but also because they are odorless and act as moisture barriers. Water cooler fan blades 5′ to 6′ long have been made of laminates to replace metal blades. Their greater cost is offset by their superior resistance to erosion from the continuous water spray to which they are exposed, by their better absorption of vibration and by their smoother operation. If the blade bends or breaks, it causes much less damage to the equipment than a metal blade would.

Mention was made above of switch panels and coil forms. That brings up the third general field of application of laminates—as electrical insulation which is not affected by moisture and temperature changes. A variety of paper-base laminates have been standardized to meet the varying requirements of electrical applications. Many of these, such as terminal boards, spacers and washers, have to be punched, and the paper-base group lends itself easily to this operation. To look for high insulation value is not enough. Other properties may also be needed for a specific application. True, a contact arm in a motor must be well insulated, but it must also take a beating from constant vibration, and the laminate used for the purpose has the strength to stand up under it.

Many Forms Available

As a highly developed industry, laminates are available in numerous stock forms—not only as sheets, rods and tubes, but also as channels, angles and other simple geometrical shapes which can be obtained by sawing the rods and tubes at various angles. Where many small parts of these shapes are required, as for spacers, cams, contact arms, levers and trips, it is economical to saw them from stock forms. Laminated tubes are made by winding impregnated sheets of the filler around a cylindrical mandrel and heating the wound sheets under pressure, much as a product made of a molding powder is molded around an insert, except that in the case of the laminate the mandrel is withdrawn. This same process can be adapted to special shapes by using a mandrel of appropriate form.

The spinning bucket which was developed for the rayon industry is a case in point. A wire-reinforced cotton fabric, impregnated with phenolic resin, is wound on a tapered mandrel to form the body of the bucket. The bottom and hub, made of chopped pieces of the impregnated cloth, are preformed and partially cured, then molded together with the body. Developed for its special purpose, this part achieves a tensile strength of 12,000-14,000 psi and a flexural strength of 18,000-22,000 psi.

What may be called another form of molding laminates which was put to greatly increased use during the war is the process known as post-forming, from the fact that the laminate, even though it has been cured to its presumably final shape as a thermosetting material, still has enough "give" to be manipulated into relatively simple forms at high temperatures. Among the parts made by this process are fairings, cowlings, inner walls (of aircraft), ammunition boxes, angles and chutes. Indicated uses in normal times are for covers, boxes and the like where strength and electrical insulation are desirable, or where a close fit can be assured by a dished form.

Generally speaking, post-forming may be used for the type of parts turned out by metal stamping, where simple angles or curves are called for. Consequently comparatively simple dies are needed. It is possible to post-form a cup shape in which the depth bears the ratio of 0.75 to the horizontal radius. As an extreme case, the laminated sheet can be bent or curved to a radius equal to its thickness, but the larger the radius the easier the operation is performed. Sheets 4′ by 8′ are available for post-forming.

Another process the development of which was accelerated in the war years is low pressure laminating or molding, which includes a pressure range from zero up to 150 lb or so. It makes possible the forming of very large sheets into forms which are difficult and impracticable, if not impossible, to obtain by high pressure methods. Much has been reported in the press of the use of the process in building boat hulls for military purposes and, more recently, for pleasure craft. The low pressure technique has also been successfully applied to pre-fabricated house parts, structural arches, furniture drawers and guards for machinery. In radar housings, low pressure laminating made possible a form of parabolic contour.

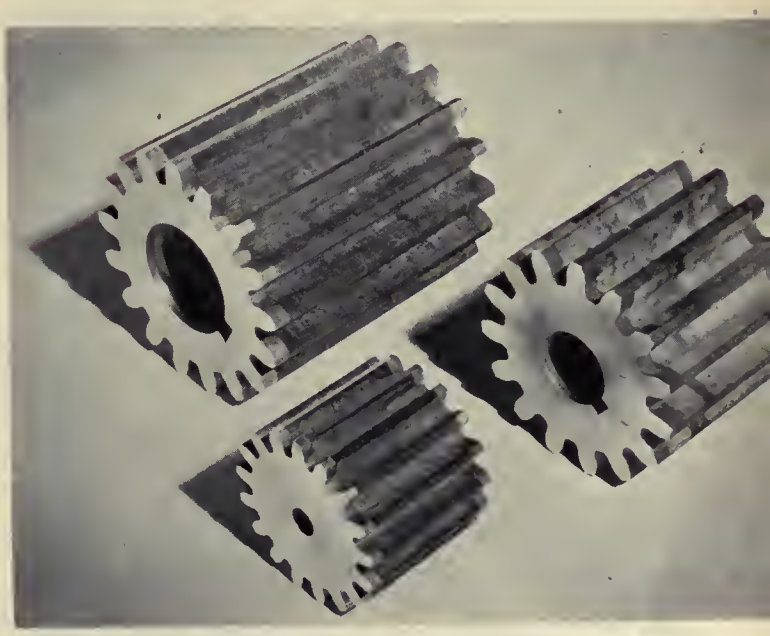
In the immediate future, its application is foreseen to such large objects as radio cabinets and cupboards, informal kinds of chairs and tables. For an excellent summary of the actual technique, the reader is referred to an article by W. Burdette Wilkins in the July, 1945, issue of ***plastics.***

This brings us back to the decorative type of high pressure laminates, which have found their greatest use so far as tabletops and bar tops in hotels and restaurants. Originally this type of laminate used phenolic resins entirely. The introduction of the urea resins made a wider range of fast colors possible, and a combination of urea and melamine resins has been found to give better service in the surface layers at least, where they contribute to the material's high abrasion resistance, heat resistance (a pot of boiling water can be set on it without damaging it), light-fastness, and resistance to the action of fruit juices and other household chemicals.

A great deal of variety is possible with this type of laminate, for the decorative layer proper can be diversified in color and pattern and material. Wood veneer inlays and metal foil can be worked into it; opaque and translucent areas can be patterned, and further diversified by color. So great is the range of possibilities that a laminate can be found or created which is not only attractive in itself but

(*Continued on page* 311)

Gears, reinforced by unwoven cotton fibers, run silently and smoothly; stand up well under hard and long wear

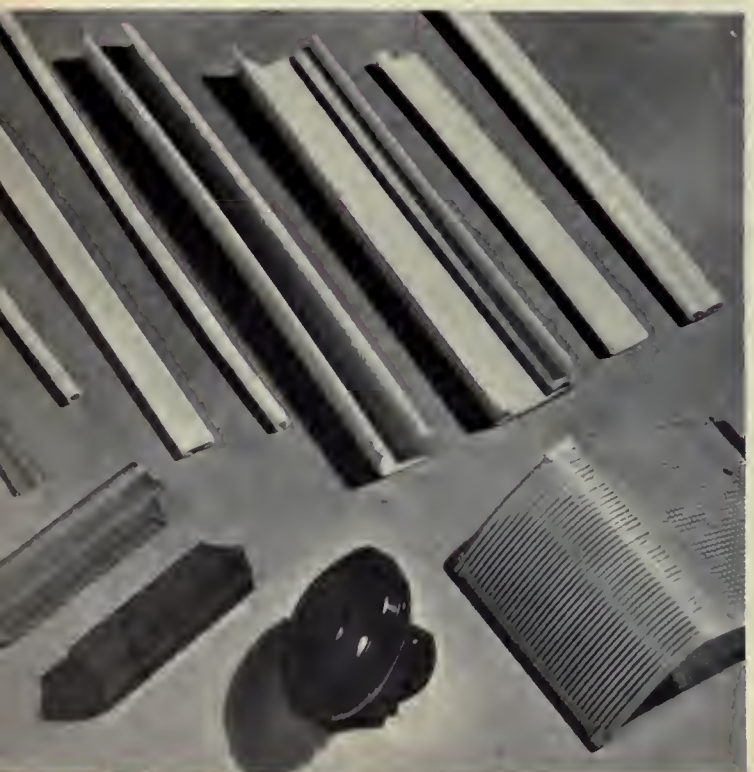


Each product a molder is asked to make demands special study of individual problems

The Molder Has His Problems

A frank discussion of the merits, limitations, uses, and misuses of plastics wherein the molder appears as the common denominator

Making a variety of products multiplies design problems



By Kenneth W. Macksey

President, Mack Molding Co.

THERE are a certain number of basic things that any reputable molder will tell a prospective customer—that is, if the molder wants to be honest with the customer and the customer is intelligent enough to want the molder to be honest with him. And honesty pays in this case because a sound plastics business, either in the processing or product end, cannot be built up by hoodwinking the customer or deluding oneself.

Some of the things to be said are negative—about the bad side of plastics—because that is often necessary in order to bring out their good points. That is why I am going to point out quite a few negatives in this article.

Let me start with a favorite bugaboo of mine: the idea that plastics can take the place of any material and have every property you can name—for example, complete absence of warpage. Some plastics have closer tolerance in this regard than others, but no plastics that I know of is 100% free of this tendency. Some years ago, my company was approached by a manufacturer of commercial sewing

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THERMOSWITCHES FOR COMPLETE TEMPERATURE CONTROL

The correct design and material save considerable grief

machines who wanted plastics to replace the metal plates on his machines. Could this be done? For answer, we furnished him with samples. Satisfied, he ordered the replacement. We machined the molds and shipped about 1,000 phenolic plates to his factory.

After six months or so, the manufacturer received letters of complaint from his customers who pointed out that the plates warped and were out of plane with the metal casting of the machine. Investigation showed that the phenolics used do warp after six months but only from 5/1000″ to 10/1000″ for a 12″ by 12″ plate. This is negligible for most applications. Unfortunately, it was intolerable for the sewing machine and had to be discarded. The manufacturer returned to the metal plates, having learned an expensive lesson the hard way.

Plastics have other limitations that the molder and his customers must guard against. Lack of needed strength and ruggedness is an example. The impact strength of certain plastics has been proved in so many applications that the

Closure threads work smoothly when carefully designed

statement is sometimes made indiscriminately that they are just as strong as metal. When this claim is taken literally, it leads both manufacturer and consumer to grief. Which brings me to the story of domes for lights on battleships.

The Navy people thought it would be a good idea to replace metal domes with plastics. My company thought so, too. We molded domes from fabric-filled phenolic material having high shock-resistance. The domes were fine until the big guns went off—and then they cracked from the repercussion. We could have remedied the situation by increasing the wall-thickness, but this would have violated specifications which called for minimum weight and volume. The Navy had to go back to metal.

Engineering Product to Application

What happened in both these cases constitutes an important moral. If the molded product is to perform satisfactorily, it must meet the peculiar conditions to which it is subjected—not some of them, but *all* of them—under service conditions. This has been said a hundred times, but it is still too often disregarded. The manufacturer coming to the molder with an idea, design or project would save considerable time, money and heartache if he would write out a complete, exhaustive list of every condition, factor and possible contingency, no matter how remote, to which the product would be exposed. Unexpected changes in temperature or pressure; cost or manufacturing time factors; gases, chemicals or other plastics substances with which it is likely to come in contact—yes, even explosions in the vicinity: any one of these circumstances may prevent successful performance.

I mentioned the significance of contact with other substances. Take cellulose acetate as an illustration. This plastics is both esthetic and utilitarian and has shown splendid qualities in operation. But place a block of transparent acetate in contact with certain types of varnish or lacquers at high room temperature and it is liable to become cloudy and discolor, owing to absorption of the varnish. This may happen even when the varnish is dry. The moral is that care must be exercised, not only in the use of acetate fixtures in paint shops, etc., but in possible contact of the plastics with varnish in the home.

In industrial processing, this factor is particularly important. In the old type of hollow gear shift ball, the acetate shell invariably suffered discoloration. Investigation showed this was due to the type of rubber compound used as a core. The plastics absorbed this material, leading to the discoloration.

Problems of the molder arise from the properties of the plastics chosen; the design of the product; the necessity of using two or more plastics and their possible interaction; molding technique, etc. For example, we sometimes use two kinds of cellulose acetate in a product. Plasticizer mixed with one kind to make it harder, may seep into the other plastics. As a result, the former will show abnormal shrinkage while the latter may undergo dimensional changes. It is important to guard against this interaction by suitable measures, if grief is to be avoided.

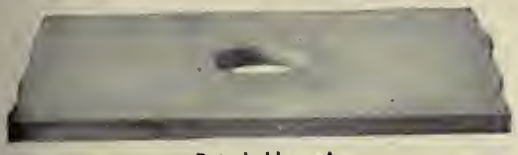
Choosing the Correct Material

Then there is the problem of the plastics material. Our company once received an order to mold phenolic handles for kitchen knives. We used ordinary wood flour phenolics, generally satisfactory for such applications. But one little factor was overlooked: the effect of constant washing and scouring of the handles in the kitchen sink. This resulted in warping and cracking of the plastics material around the knife shank. It was not phenolics as a class that were at fault, but the particular type used. This was proved by the good results that followed substitution by another

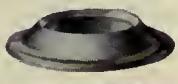
(*Continued on page* 308)

NEW INSTALLATION METHOD FOR DZUS* FASTENER STUDS CUTS ASSEMBLY TIME 50%

Stud



Detachable part



New Grommet

Stud Assembly

Cut-away view of complete Dzus assembly

Shown above are the component parts and steps in the assembly of the Dzus spiral cam fastener, using the newly designed grommet.

A newly developed Dzus grommet slashes installation procedure about 50%. This speeds up the assembly of Dzus fasteners for mass production operations.

This is the way it works. Dzus fastener studs are placed in the holes drilled or punched in the material to be fastened. The grommet is then slipped over the end of the fastener stud and flattened with a single tool. **All types of Dzus fasteners may be installed in this manner.**

If you have a fastening problem on a hinged or removable part, let a Dzus engineer help you. There is a Dzus fastener to meet every requirement.

*The word Dzus is the registered trade mark of the Dzus Fastener Co., Inc.

DZUS FASTENER CO., INC.

BABYLON · NEW YORK

IN CANADA: RAILWAY AND POWER ENGINEERING CORP., LTD.

KRISTON

Trademark B. F. Goodrich Chemical Company

PROPERTIES OF THE MONOMER: The allyl ester (monomer) as supplied is a pure chemical compound, water-clear and of syrupy liquid consistency. It has a high molecular weight with corresponding low vapor pressure and high boiling point. The specific gravity varies from 1.26 at 10° C. to 1.178 at 130° C. The viscosity changes from 50,000 Centipoises at 22° C. to 12 at 126° C. The refractive index is 1.5483 at 28° C. It is soluble in ketones, esters, ethers, alcohols, and aromatic hydrocarbons. Per cent shrinkage on polymerization (from monomer at room temperatures to polymer at room temperature) is 3.25 to 4. It is stable indefinitely when stored at 0° C.

CATALYSTS FOR POLYMERIZATION: Many types of catalysts have been tested, but interest has centered on the *organic peroxides*. Of these, *benzoyl peroxide* has proven easiest to handle and most foolproof.

MOLDS: Preliminary studies indicate that both ferrous and non-ferrous metals may be used for mold construction. Molds of glass serve exceptionally well but, of course, are subject to inherent hazards. Neither glass nor metals appear to require mold lubrication. Densely cast Plaster of Paris, with surface properly prepared, can be used.

FINISHING: KRISTON polymer is best cut by sawing, preferably with a band saw. Very thin sections (0.05 inches) are cut rapidly and without chipping by using the back edge of a fast-moving metal-cutting blade. Thick sections may be cut with the sawing edge of metal-cutting blade but slight chipping results. Where speed is more important than the final finish, the wood-cutting blade may be used. Saw marks or deep scratches may be removed by sanding with progressively finer sand or emery papers. Polishing is done with jeweler's rouge suspended in a light oil and spread on a soft felt wheel.

COLORS: While KRISTON polymer in the natural state is crystal clear, it may be produced in transparent, translucent, or opaque colors. Specific recommendations are available as required.

PROPERTIES OF POLYMER

For studies of properties, KRISTON monomer without coloring or extending agents was polymerized under controlled conditions to a uniform hardness of 40 as measured by the Barcol Impressor. Where a range of values is shown for a property, the data indicate maxima and minima which may be obtained by varying the degree of polymerization.

	Test Method		Value
1. Specific gravity	A.S.T.M.	D 792-44T	1.34—1.40
2. Flammability, in./min.	A.S.T.M.	D 635-41T	Self-extinguishing
3. Coefficient of linear expansion	A.S.T.M.	D 696-42T	9×10^{-5}
4. Dielectric strength, v.p.m. (step-by-step—.017" thickness)	A.S.T.M.	D 149-40T	1275
5. Dielectric constant and loss factor at 120° C.	A.S.T.M.	D 150-42T	

	60 c.p.s.	1000 c.p.s.	10,000 c.p.s.
Dielectric constant	4.00	3.88	3.75
Loss Factor	.0603	.0815	.101

6. Volume resistivity, x 10^{14} ohm—cms	A.S.T.M.	D 257-38	
a. Over the range— 10° C. to +110° C.			Too high to measure
b. At 120° C.			6.8
c. At 130° C.			6.2
7. Refractive index, $20/D$	A.S.T.M.	D 542-42	1.57
8. Chemical resistance	A.S.T.M.	D 543-43	

Maximum *weight change* after 7-day immersion in 16 different materials ranged from —0.11% in 10% sodium hydroxide to +0.32% in 95% ethyl alcohol.

There was no *dimensional change*. (Thickness was measured.)

There was no change in *general characteristics*.

Data presented herein are based upon tests believed to be reliable. However, no guarantees are expressed or implied.

For a booklet containing more detailed technical data please write B. F. Goodrich Chemical Company, Department PC, Rose Building, Cleveland 15, Ohio.

B. F. Goodrich Chemical Company A DIVISION OF THE B.F. GOODRICH COMPANY

KRISTON

A new group of thermosetting allyl ester monomers having exceptional electrical, chemical, and optical properties, unusually high heat and flame resistance

The Kriston castings shown in this photograph were not intended to suggest specific end products, but rather to illustrate the variety of forms in which Kriston can be fabricated and to demonstrate its optical properties, color, and jewel-like finish. In the picture are rods, color plaques, balls, cast sheets (cigarette box), a lens, a rose cast in an ornamental paper weight, and two samples of fabric laminations. All these samples were prepared in the laboratory, and those few pieces requiring final finishing were machined and polished on standard equipment.

Suggested Applications: In the optical field, Kriston's excellent clarity and high refractive index (higher than most optical glass) suggest uses as fine ground and polished lenses, prisms, reflectors, and refractors. Where less precision is required it should be possible to cast such pieces as optical contact lenses, camera lenses, decorative pieces for the home, window display stands, or any other application where the required beauty, transparency, or translucency of the end product can be obtained by simple casting with a minimum of finishing.

Kriston's unusual electrical properties and stability suggest applications such as control panels and knobs, rigid insulating sheets or separators, cast parts for switches, fuse boxes, amplifiers, and other similar equipment.

Kriston's resistance to fats, oils, and greases as well as most chemicals should suggest a wide variety of applications in the food and chemical industries.

In the fields of fashion and decoration Kriston should find uses ranging from lamp bases, picture frames, and lighting fixtures to clips and other costume jewelry.

Without doubt countless other applications will be suggested and found practical for Kriston.

KRISTON

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ROSE BUILDING, CLEVELAND 15, OHIO

See next page for more detailed information

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LUMARITH EC (ethyl cellulose thermaplastics) Molding Materials, Sheets, Films, Foils

FORTICEL† (cellulose propionate thermoplastic) Molding Materials, Sheets, Rods, Tubes, Films

VIMLITE* (wire or plastic-mesh reinforced cellulose acetate coated plastic glazing) in rolls

*Reg. U.S. Pat. Off.
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LUMARITH CA (cellulose acetate thermoplastic) Molding Materials, Sheets, Rods, Tubes, Films, Foils

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Machines for Better Production

A review of some of the recent developments in apparatus and equipment designed especially for the improvement of plastics processing, fabricating, testing

Top-notch machinery like this radial drill means greater efficiency, increased economy, higher quality of product

THE year 1945 saw American production reach an all-time peak. In the plastics field, particularly in the first 6-8 months of the year, new products and applications for military and other war-time uses were designed and created with the speed engendered by necessity. With energies concentrated on such production, industrial designers and manufacturers nevertheless managed to look ahead to post-war demands, although it was not then possible to proceed along some of the lines which they envisioned, because of the importance of war requirements.

Machinery designers and manufacturers gave all possible thought to the improvements of existing machinery for plastics and as quickly as they could, brought out new and time-saving items and units.

Among new or radically improved machines for use within the plastics industry, a number of those developed during 1945 are listed and described below:

Coating Machines

A series of new type plastics coating machines have been designed by Youngstown Miller Co., Sandusky, Ohio. These machines may be used to melt ethyl cellulose and other compounds for strip coatings as well as low temperature plastics for permanent coatings. Twenty-two different models with a wide range of dipping compartment sizes and melting capacity are available.

Plast-O-Dip Model 3 (Aeroil Burner Co., West New York, N. J.) is a double-boiler type of hot dip tank designed to meet the needs of firms having small parts, tools, etc., which they want to protect by plastics protective coverings. Rigid control of temperature, built-in dial thermometer, and extra-heavy insulation are chief features of this tank.

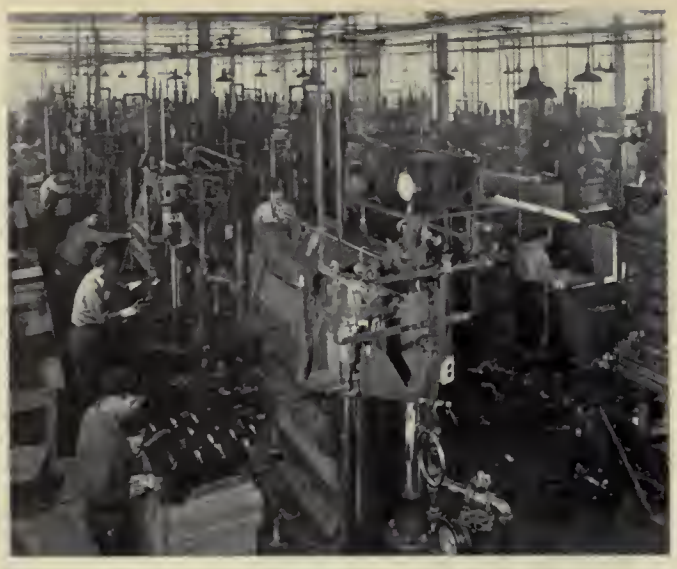
The *Haas Laminator* (Transparent Protection Co., Newark, N. J.) will soon be available to permit individual companies to laminate on their own premises. This portable machine automatically applies transparent cellulose acetate by heat and pressure to any paper stock from tissue thin material to cardboard. It uses either the pressure sealing or heat sealing type of film, and can cover one or both sides of the paper stock at a time. The heating element is thermostatically controlled. The machine is available in two sizes—one which will take material up to 24″ wide and the other 12″. Speed ranges from 5 ft to 15 fpm.

A new treating and drying apparatus has been designed and built by J. O. Ross Engineering Corp., New York, for handling laminated glass cloth using synthetic resins. This system provides features for controlling air circulation in temperatures necessary properly to produce glass cloth laminates and similar products. Uniformity in drying is accomplished by means of tempered high velocity air in sufficient volume to assure proper distribution of lifted solvents.

Machine Tools

BUFFERS: The Standard Electrical Tool Co., Cincinnati, Ohio, has developed a new line of buffing and polishing machines, suitable for the finishing of plastics items. These machines vary from one to 15 hp and from a weight of 255 lb to 2425 lb. A "speedial" control permits almost instantaneous speed changes from 1500 to 3000 rpm. Other features include push button starters and taper arbors.

GRINDERS: Two all-purpose disc grinders, for heavy and regular duty, are available through Kindt-Collins Co., Cleveland, O. These grinders are designed for any type of metal, wood or plastics material. Disc speed is 800 rpm, giving a 6260 fpm rim speed. Principal features include a



Frequent and significant improvement in molding presses of all types is the rule rather than the exception

30″ disc; hydraulic controls for raising, lowering or tilting the table; an accurate position stop, which can stop the table in any position from 45° down to 15° up; a ventilated table with efficient dust guards; and a design which permits removing or replacing paper or cloth discs without removing the steel disc.

A versatile 24″ disc grinder has also been developed by the Kindt-Collins Co., and will soon be available for distribution. This machine is adaptable to all kinds of grinding on plastics, metal and wood. Special features include a heavy ribbed table, which tilts 45° down and 25° up; and a grinding disc on which both faces can be used.

A *Hydraulic Feed Universal Tool and Cutter Grinder* has been developed by Gallmeyer & Livingston Co., Grand Rapids, Mich., with special emphasis for use in the plastics industry. Two models of these grinders are available with table speeds ranging from 4″ to 50′ a minute. The machine is equipped with a greased-for-life precision cartridge-type ball-bearing spindle and a four-speed motor drive headstock and provides for work speeds of 80, 160, 260, and 525 rpm.

LATHES: A light-duty speed lathe designed for economical general finishing operations on small plastics and metal parts has been developed by the Schauer Machine Co., Cincinnati. The motor is single speed, 3450 rpm, ¼ hp for 220-440v, 60-cycle, 3-phase, and the motor is designed to use type 3C collet with maximum capacity for ½″ round stock; it can also be equipped with 3″, three-jaw light-duty chuck.

Specially designed for use where exceptionally high speed and short cycle machining are required, the *Le Blond 13″ Motor Head Rapid Production Lathe* (R. K. LeBlond Machine Tool Co., Cincinnati) picks up full speed in two seconds, stops in 2½ sec, according to its description. Among other features listed are: new type motor head; rigid construction, enabling operator to bring speed up to 3600 rpm and stop the spindle five times per minute; and full control of machine maintained by operator at all times, from push-button control station mounted at top of machine.

MILLING MACHINES: Two new models of the W. H. Nichols double-spindle melting machines, capable of medium duty work on plastics or metals have been announced, with these features: spindles of heavy alloy mounted in permanent ball bearings; spindle nose hardened and ground; work table of special wear-resistant alloy, operated either by screw or rack and pinion, and fitted with graduate stops; all slides pressure-gun lubricated; and quickly re movable coolant tank in base.

Ovens and Heating Devices

A standard box-type oven for high-speed evaporatio and drying of alcohol, napthas, methyl-ethyl-ketone, an other highly volatile solvents is offered by Industrial Ove Engineering Co., Cleveland. These oven may also be easil converted for other types of drying, finishing, heat treat ing or heat processing where materials can be handled i trays, jigs or baskets. Door sizes range from 3′ by 3′ t 5′ by 6′ and temperature range is 150° to 900° F. with tolerance of ± 2°. Although direct gas fired, this ove has been proved safe in the evaporation of large volumes o inflammable and explosive materials and has insurance com pany approval.

A new type of oven for preheating thermosetting plastic has been announced by Maico Co., Minneapolis. In thi oven, the plastics material is tumbled during the heatin process, bringing it to a much higher temperature tha would otherwise be possible. The oven is thermostatically controlled with electric heaters, and the preheated materia is emptied directly into the molds.

An easily portable, compactly designed megatherm, des ignated as *MD-1A*, with nominal output of 1 kw, for high frequency heating of a wide range of dielectric material has recently been developed by Industrial Electronics Divi sion of Federal Telephone & Radio Corp., manufacturin associate of International Telephone & Telegraph Co. Thi machine is described as ideally suited for preheating o plastics preforms. Uniform through-heating of preform is said to be accomplished with great saving of time, an production of molded parts considerably increased by use o this unit.

A thermatron dielectric heater, the Radio Receptor C *Heatmaster*, is applicable for plastics, dehydration, steriliz tion and other purposes. Generating more power than an other unit of its size, it is stated, the Thermatron *Hea master* is described as a compact model, particularly de signed for heavy-duty preheating in the plastics moldin industry wherever floor space is at a premium. This heate is said to be capable of heating a 3.3 lb preform in 1 mi or a 5 lb preform in 90 sec and to possess capacity makin it suitable for rugged general purpose production, as we as research requirements involving substantial power.

A shelf-loading oven with a self-contained heating sy tem has been developed by Gehnrich Oven Div., W. Rockwell Co., N. Y., to meet baking or drying operation where quick removal of volatiles produced by heating th work is required. This oven is made with four doors fo easy access to any section, and is said to offer safe, unifor baking, drying or curing. Temperatures range from 100° t 1000° F.

Announced as a new type of mill applicable to the dis integrative treatment of all types of fluid mixtures, th *Asbury Fluid Impactor* (Asbury Corp., Doylestown, Pa. is said to make possible higher temperature homogenizatio featuring a specially designed rotor to produce impact upo a liquid through centrifugal force. The rotor, of stainles steel, has a speed of 3600 rpm to 15,000 rpm, variable t meet individual conditions; motor is one to 7½ hp on ac o dc; the machine is 22½″ high, occupies floor space 17½ by 36″, and has a net weight of 400 lb. Other features in clude: concise action of discharge outlet; novel design an arrangement for temperature control; balanced unit easil replaceable; circulating oil pumps with sight gravity fee and air seal incorporated into unit.

Designed to fill a number of uses in the industrial an research laboratory as well as in industry, a "constant tem perature and plastics melting tank" is soon to be introduce

SPECIFICITY, *precise adjustment to one specific application*, is the distinguishing characteristic of Interlake Resins.

THEY are made—not to do several jobs—but to do *one job well*—and to keep on doing it *uniformly!*

They are called *specification resins* because Interlake, in each case, functionally engineers one resin to the specific requirements and conditions of *your* application—tests it on *your* job, in *your* plant—then stabilizes its production for continuous uniformity in performance.

That is why important industrial users come to Interlake when contemplating new resin applications—or—when a presently used resin is *not* fully meeting the functional and production requirements of a particular job.

The largest, the smallest and the most intricate pieces ever molded have been molded of Makalot Thermosetting Compounds.

WHATEVER properties have been required of molded materials—and, in not a few instances, properties desired *but never previously thought possible*—have been obtained by molders using Makalot Compounds.

Interlake has low loss Makalot Compounds for high frequency applications, non-cracking for molding around inserts, non-shrinking, heat resistant, general purpose, super-impact, X-ray or sweat resistant, or with brilliant surface lustre—and—*every one* of these compounds has been proved in successful use by some of the country's foremost molders.

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Interlake will supply a Specification Resin or a Makalot Compound *exactly suited to your application.* Write Interlake Chemical Corporation, Plastics Division, 1935 Union Commerce Building, Cleveland 14, Ohio.

The phenomenal development of injection molding in the U. S. owes a great deal to the machinery manufacturers

to the market, according to announcement from its makers, Laboratory Specialties, Inc., Wabash, Ind. It is an 11 gal. welded steel tank surrounded by *Transite* insulating material and provided with immersion type heating elements of 2000 w. capacity, an electric stirrer, cooling coils, and temperature controls, and maintains temperature to any specified degree, between the temperature of the cooling liquid and 400° F.

The *Mighty Midget* (K. H. Huppert Co., Chicago) is described by its makers as representing a "revolutionary departure from accepted laboratory and small unit production furnace standards." Only 8½" by 10½" by 8½" in outside dimensions, the *Midget* is designed to maintain any desired temperature from 200° F to 1750° F. All-steel construction, multi-insulation, special high temperature alloy elements, indicator light, and indicating pyrometer are among the features listed for this item.

Large capacity, compactness and ready portability are among the many advantages offered by the new model *88X0 Red Head Thermex* (Girdler Corp., Louisville) high frequency dielectric heating unit. This machine has an output of 5 kw delivered at approximately 20 megacycles and will raise the temperature of 4 lb of average purpose material 170° F in one minute. Control is completely automatic and it is claimed that, because this unit rapidly and uniformly preheats preforms, it shortens molding cycles by as much as 300%, enhances product quality and prolongs the life of both the press and the mold.

X875 Thermex (The Girdler Corp., Louisville) was designed especially as a production unit for the plastics molding industry. Weighing only 250 lb and 15" by 23" by 29" in size, it has an output of 400 watts.

Presses

A press which operates as a conventional injection, compression or transfer molding machine or as a combination of all three has been announced by the Improved Paper Machinery Corp., Nashua, N. H. The versatility of this machine is obtained through the use of a vertical clamping unit in combination with a horizontal injection unit. Contained in the vertical unit is a compression ram which operates up through, but independently of, the stationary die platen. With this combination, results are obtained, it is said, that are far beyond the scope of conventional machines. Advantages include: faster, improved techniques for molding large castings of heavy cross-sections; savings in finishing costs; improved quality of molding; closer tolerances; elimination of shrinkage and voids on heavy sections; injection molding of large projected areas; and flexibility of molding design.

A series of semi-automatic compression and transfer molding presses ranging from 50 to 1200 tons were developed during 1945 by Watson-Stillman, Roselle, N. J. These presses are equipped with T-slotted platens, top and bottom mechanical ejectors, double-acting ram, electrical automatic single cycle control incorporating timer for setting pressure dwell period, and with built-in power unit. The presses are powered by motors ranging from 3 to 25 hp and exerting operating pressure of from 2200 to 2500 psi.

Important improvements, based on more than seven years' experience, are reported by the F. J. Stokes Co., Philadelphia, as being incorporated in its latest No. *200 D* completely automatic molding machine. Among these improvements is a new type checking device, sensitive to the fraction of a gram, which weighs the finished moldings and operates a safety cut-off to stop the machine in the event that all molded pieces do not eject into and pass through the trap. Should a piece stick in the mold or a molding be of insufficient weight, it is explained, the machine will stop and signal for attention, thus practically eliminating possible damage to the mold or to the machine from double filling or other failure in operation and helping to assure high quality moldings.

A newly designed combination compression and transfer molding press has been announced by French Oil Mill Machinery Co., Piqua, O. Among its many features are: hydraulic pumping equipment built into the bed of the machine; quickly changeable timing intervals and changes from one type of molding to another; and a fully automatic cycle controller.

Defiance Machine Works, Inc., Defiance, O., has designed a new transfer molding press which is said to permit highly accurate production, with reasonable cost, reduction of waste material, and few rejections of finished products. Maximum working pressure of 300 psi exerts a mold clamping pressure of 170 tons through main ram, dia. 12"; a 42-ton transfer pressure (at 3000 psi) is exerted through the transfer cylinder, diameter 6". Maximum mold width 18", length 26"; minimum working space between platens 15", which can be increased in 2" increments up to 23"; platen stroke 15"; minimum mold height with upper platen in highest adjustment 13½"; in lowest adjustment 5½".

A series of completely automatic self-contained upward-acting electronic compression molding presses recently developed by Hydraulic Press Manufacturing Co., Mount Gilead, Ohio, is available in sizes ranging from 50 to 300 tons. Among the advantages listed for these presses are: the unique design in which the hydraulic power unit is mounted integral with the press, thus saving floor space; automatic lubrication; permanent metal packings; a minimum of piping; and independent pressure control.

Quick, accurate, low-cost extrusion of thermoplastics in any design are possible through the *Pelco B-103*, according to its manufacturer, Midwest Production Machine Co., Columbus, O. This laboratory-type extruding machine is all electric and completely self contained, presenting no installation problems, since it can be operated on any suitable work table or bench and connects to standard electrical current outlets. Heat range is up to 600° F, thermostatically controlled. The machine has a variable speed drive, weighs 200 lb, and its base size is 21" by 25".

Five new injection molding presses have recently been announced by Reed-Prentice, Worcester, Mass. These are models 10D (6 and 8 oz), 10A (4 oz), 10E (12 oz), 10F (16 oz) and 10H (22 oz). Among the many features of these machines are: a new double shear link mechanism which increases rigidity and reduces maintenance; a one-piece welded steel base; hydraulic piping and valves; new

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type guards, easily removed for maintenance; electric timing clocks, mounted in dust tight boxes; transparent plastics windows for safety doors; and plug-in connections.

A 1 to 2-oz injection molding machine has been designed by Sav-Way Industries, Detroit, for experimental, educational and production use. Some of the features of this *Pacemaker* machine are: capacity of 20 tons; mold casting area of 4 sq in; stroke 11½"; lower platen 10" by 10"; current 220 v, 3-phase; heating elements 1000 w; line pressure 0 to 2000 psi; large capacity hopper with convenient manual quantity control; and independent switches for heating elements and hydraulic system.

Designed to offer a low-cost, economical injection molding machine for testing small plastics molds and single cavities, thus eliminating the "tying up" of large production machines for this purpose, the *Midget Molder* (Van Dorn Iron Works, Cleveland, Ohio) can also be used to good advantage in smaller plants. Hand operated, this machine will shoot up to ¾ oz of thermoplastic material, and its design permits adjustment of the plunger stroke and easy installation of different lengths of heaters for experimental purposes. Features include: a clear platen area 8" by 8"; built-in heater controls; and a toggle mechanism for quick opening and closing and rigid clamping of the mold.

Hydraulic Press Manufacturing Co., Mt. Gilead, Ohio, has designed a new injection molding press, model 350-H-16. This machine has a hopper capacity of 100 lb, a plasticizing capacity of 100 lb per hour, and exerts an injection pressure of up to 20,000 psi. Its overall size is 185" by 50" and it is 91" in height. A hydraulic mold clamp provides positive scaling of mold, rapid die change-over and automatic slow-down. A newly designed plastics heating chamber, equipped with electric band heater, makes for ample plasticizing capacity, with accurate zone heat control. Each pump valve and control in the machine has been designed especially for heavy duty molding service.

A newly designed injection molding press has been announced by Hy-Speed Press Co., Chicago. This unit molds up to 2 lb of material, is automatic in cycle and is fed by an automatic feeder. It will cast to an area of 60 sq in and has up to 400 tons holding pressure and 8 times greater in the injection ram. Special units can be designed to take care of larger areas and up to 4 lb in volume. Floor space required is 36" by 60" and the weight is 5 tons. The cabinet is so designed as to make all compartments easily accessible for adjustments and cleaning, and the machine is equipped with lights to enable the operator to see whether the mold remains clean after each cycle.

Included in the newest developments are improved presses and ovens for the fast-growing laminating industry

A 50-ton self-contained platen press for the molding of plastics products was announced recently by R. D. Wood Co., Philadelphia. It may be operated at any required pressure from 200 psi to 1000 psi, with corresponding tonnage variations of 10 to 50 tons through adjustment of pressure control hand wheel. Pressure is supplied by a duplex rotary piston pump driven by a 3 hp 1200 rpm motor, pump having a low pressure capacity of 34 gpm at 150 psi and high pressure capacity of 3.68 gpm at 1000 psi. Ram diameter is 11½"; bolster sizes 20" by 6". The press, 8' in height, occupies floor space of 4' 10" by 3' 4½" and weighs 7500 lb.

The same company has announced a new steam platen press designed for laminating, curing and polishing plastic sheets to uniform thickness and surface finish. This 10" opening 2700-ton press has a quick loading and unloading mechanism, which permits moving material in and out of press without in any way contacting the polished plate surface, thus eliminating scratching or scoring of the highly finished platens. The press may be furnished as a completely self-contained unit and in capacities up to 7500 tons with steam or electric heated platens as required.

A punch press which works equally well on plastics, metal, cloth, wood and rubber materials has been produced by the Maxant Button & Supply Co., Chicago. Among its features are an open face construction which permits quick change of dies, a quickly adjustable ram for distance of stroke, and ready adjustability of strokes per minute. It has a throat height of 10", depth 4"; distance of bed to slide 7¼"; bed area 9" by 8"; stroke 2½".

A line of positive self-contained hydraulic presses adaptable to all sizes and types of shops, has recently been announced by Munton Mfg. Co., Franklin Park, Ill. These presses are available with self-contained motor drive for production work, and in capacities ranging from 4½ to 25 tons. Among their features are: ruggedness of construction, with heavy reinforcement where needed; gap-type design to facilitate work clearance, and finely engineered rams, which are interchangeable on the various presses permitting variety of speeds at high or low pressures.

A fully automatic, high speed forming press, described as being capable of drawing plastics containers at great savings in time and labor is being produced by F. L. Smithe Co., N. Y., under license from Celanese. The press is particularly good at forming *Celluloid* and *Lumarith* plastic parts, but will perform equally well on all thermoplastic films.

Although originally designed for laminated plastics use the *Francis* steam plate press (Chas. E. Francis Co., Huntington, Ind.) is suitable for a wide variety of plastics work. It is said to be particularly useful in the manufacture of plastics playing cards or similar items. It has a motor driven pump unit, automatic pressure and temperature controls, and is equipped with 11 steam plates.

The Preco Hydraulic Laminating and Laboratory Press (Preco, Inc., Los Angeles) is designed for almost all small-scale pressure tests or operations. Standing only 27½" high and weighing 200 lb this press can be used to mold plastics, wood, paper, powdered metallurgy, synthetic rubber; to laminate plastics, resin impregnated wood, paper and fiber glass; for compression tests, glueing tests, extrusion tests; for separating liquids and solids, embossing, coating electrical elements and many other uses. The pressure gauge is accurately calibrated in platen pressure from 0 to 40,000 lb.

A special spring construction in the *Terkelsen Electro-Draulic Press* (Terkelsen Machine Co., Boston) permits pressure to be changed from a few hundred pounds to 50

(*Continued on page* 303)

WHEN MOSINEE MARCHES HOME AGAIN!

MOSINEE is one of the "proved-in-service" materials emphasizing great technological strides in product engineering. MOSINEE is "marching home again" with a creditable "service record" in fields of duty that formerly were unexplored.

The "paperologists" of The Mills of Mosinee are fortified by broad experience, plus the finest of laboratory and production facilities. Cooperation of Mosinee engineers with manufacturers in many lines has resulted in improving product-quality, expanding product-utility, lowering production costs . . . thus helping to open new opportunities, new markets.

A conference with Mosinee "paperologists" might disclose similar opportunities for you. Mosinee is ready.

MOSINEE PAPER MILLS COMPANY
MOSINEE • WISCONSIN
Essential Paper Makers

Please address your letter "Attention Dept. E"

Simple or Intricate Parts INJECTION molded
Rods-Tubing-Tapes Special Forms in EXTRUSION molded
Also Manufacturers of Shatterproof PLASTIC CONTAINERS
We have facilities for producing a wide variety of products by extrusion or injection molding.
Intricate or simple parts by Injection, —up to 9 ounces per shot, including such items as handbag frames, first-aid boxes, toys, etc . . . .
Continuous lengths of Extrusion moldings in many diameters, various shapes; your choice of color, flexible and rigid, transparent and opaque.
Our plant is capable of handling your needs, with special emphasis on volume production.
Our Engineering Staff is at Your Service

CELLUPLASTIC CORPORATION

PLASTIC CONTAINERS
AND
PLASTIC PRODUCTS

46 AVENUE L NEWARK 5, N. J.

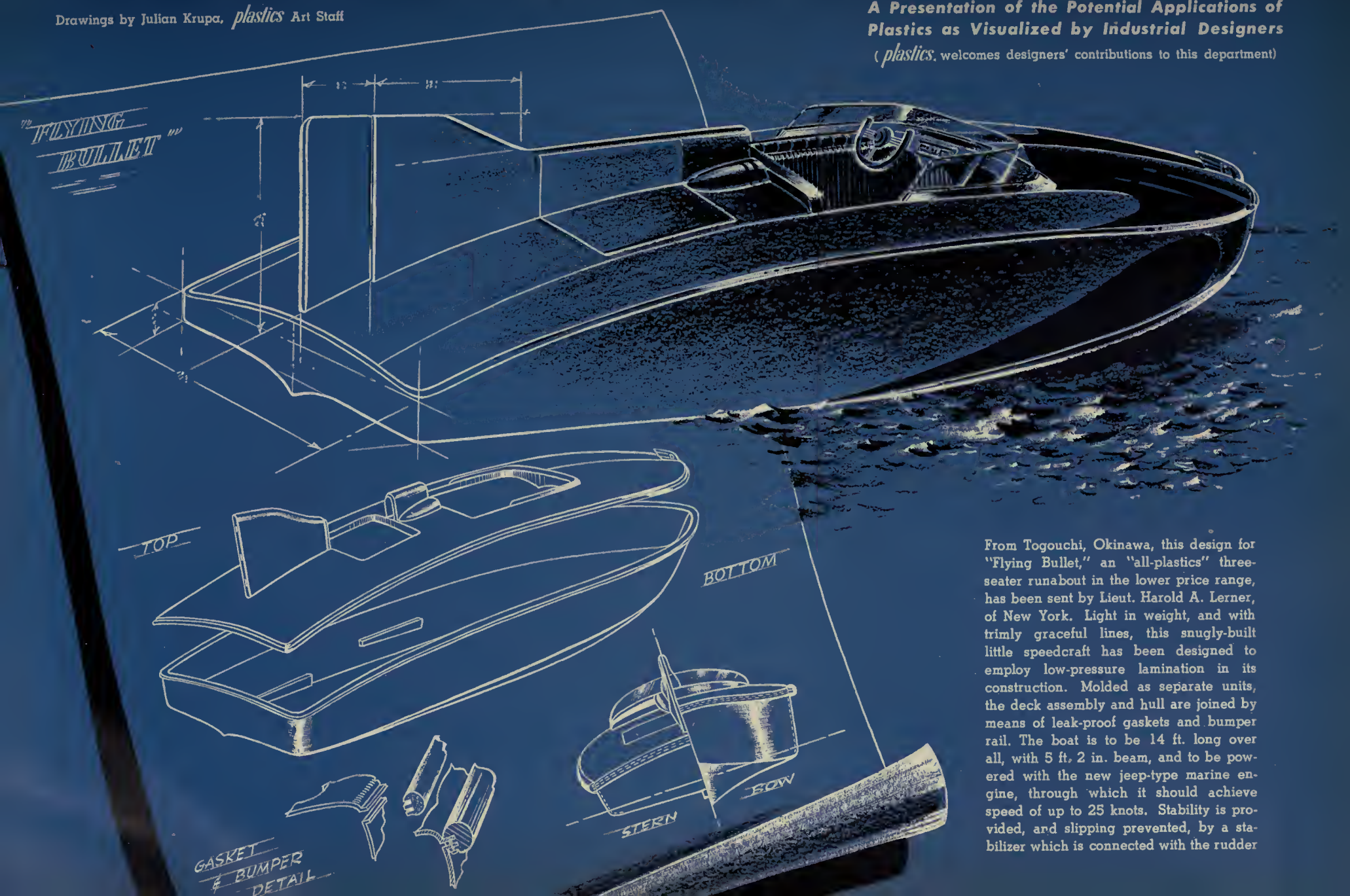
NEW YORK OFFICE—630 FIFTH AVENUE WEST COAST: CONTAINER SERVICE COMPANY, LOS ANGELES 27, CAL.

ON THE DRAFTING BOARD

Drawings by Julian Krupa, *plastics* Art Staff

A Presentation of the Potential Applications of Plastics as Visualized by Industrial Designers

(*plastics*, welcomes designers' contributions to this department)

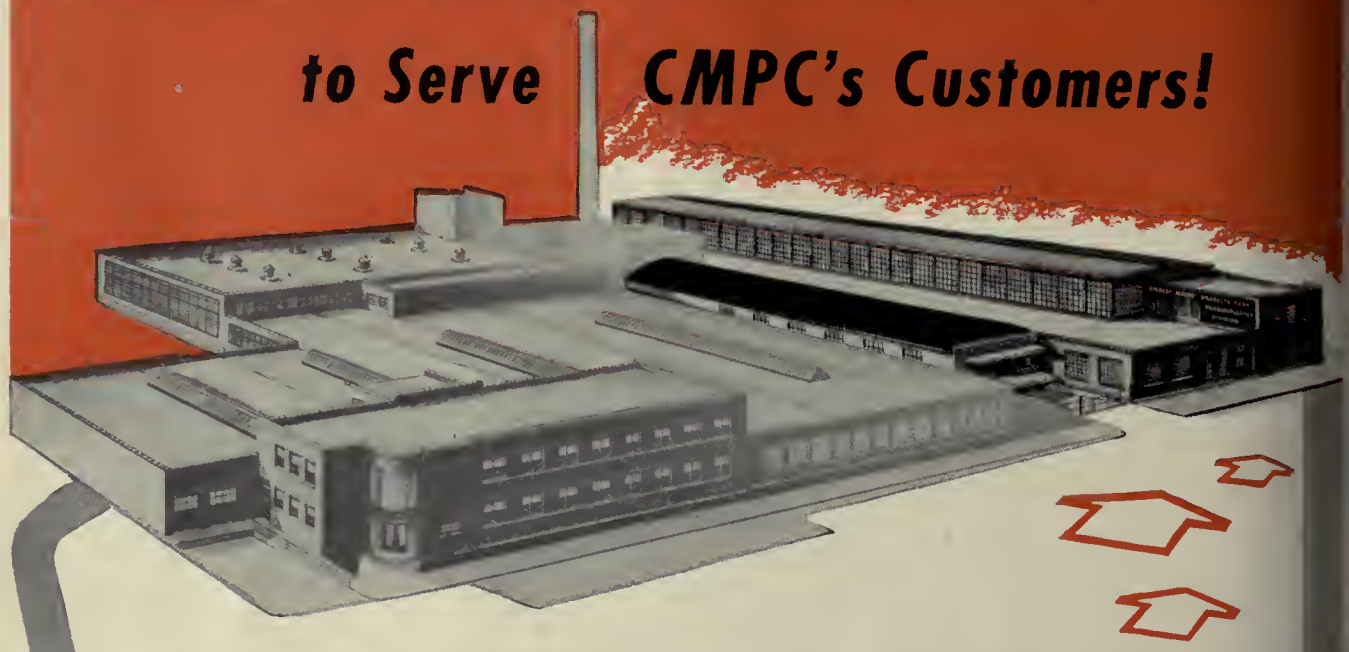


From Togouchi, Okinawa, this design for "Flying Bullet," an "all-plastics" three-seater runabout in the lower price range, has been sent by Lieut. Harold A. Lerner, of New York. Light in weight, and with trimly graceful lines, this snugly-built little speedcraft has been designed to employ low-pressure lamination in its construction. Molded as separate units, the deck assembly and hull are joined by means of leak-proof gaskets and bumper rail. The boat is to be 14 ft. long over all, with 5 ft. 2 in. beam, and to be powered with the new jeep-type marine engine, through which it should achieve speed of up to 25 knots. Stability is provided, and slipping prevented, by a stabilizer which is connected with the rudder

SOON . . . A New and Bigger

THERMOPLASTICS MOLDING DIVISION

to Serve CMPC's Customers!



CMPC now takes another great step forward. This time it's a new, expanded Thermoplastics Division, housed in its own modern building for maximum efficiency, and staffed throughout by CMPC's seasoned personnel. Steps already completed, or under way, include:

- The purchase of a modern building 200 feet long, immediately adjoining our main plant on the north.
- The construction of a new section to join the two plants.
- The installation of new, up-to-the-minute injection molding machines ranging up to twenty-two ounces . . . enabling us to *triple* our former production of injection molded parts.

These new facilities will be in full operation this summer. But they are only the beginning . . . the first step in a million dollar expansion program to make CMPC's outstanding facilities for compression and injection molding available to more industrial users of plastics than ever before. So if you are planning to use molded plastics in the future, we invite you to take advantage of these expanded facilities, backed by CMPC engineering skill. Just call in a CMPC Development Engineer. There's no obligation.

Plastic **CHICAGO MOLDED PRODUCTS CORPORATION** Molders

1031 N. Kolmar Ave. Chicago 51, Illinois

COMPRESSION AND INJECTION MOLDING OF ALL PLASTIC MATERIALS

plastics

SECOND ANNUAL DIRECTORY

Adhesives 86
Calendering 86
Casting Resins 86
Chemicals 86
Coaters 98
Exporters 100
Fabricators 100
Heat Sealing 102
Impregnating 102
Laminating, Impregnating, Coating Materials 102
Laminators 102
Machinery, Equipment 104
Molders 124
Plastics Materials 132
Plywood Facing 132
Plywood Molding 132
Plywood, Resin Bonded 132
Scrap Dealers 132
Special Services 132
Tooling Materials 140

Comparative Guide to Physical Properties

GENERAL PROPERTIES 142
MECHANICAL PROPERTIES 144
ELECTRICAL PROPERTIES 150
THERMAL PROPERTIES 156c
OPTICAL PROPERTIES 156f
STABILITY 156h

Tables of Properties

CAST PLASTICS 158
COLD MOLDED PLASTICS 162
LAMINATED PLASTICS 164
MOLDED PLASTICS 178
MOLDING BLANKS 209
RESIN FIBRES 210

Buyers Guide to Plastics Products 212
Directory of Names and Addresses 221

plastics Annual Directory

On this and following pages, *plastics* publishes its Annual Directory. This first part of the directory is an index to the manufacturers who supply the plastics parts and products, and the materials, equipment and supplies used in their manufacture. Also additional classifications are listed here, which together with the others combine to form the entire plastics industry and its associated industries. The names and addresses of all the firms listed here will be found beginning on page 221.

Every effort has been made to insure accuracy of listings, based on data supplied by manufacturers.

ADHESIVES

Adhesive Products Corp. (N.Y.)
Alkydol Laboratories, Inc. (Ill.)
American Cyanamid Co. (N.Y.)
American Cyanamid & Chemical Corp. (New York)
American Products Mfg. Co. (La.)
American Resinous Chemicals Corp. (Massachusetts)
Bakelite Corporation (N.Y.)
Beutex Corp. (N.J.)
Bury, Robert & Co., Ltd. (Ontario, Canada)
Carbide and Carbon Chemicals Corp. (New York)
Cardinal Chemical Co. (N.Y.)
Casein Company of America (N.Y.)
Chemical Plastics, Inc. (Minn.)
Chicago Show Printing Co. (Ill.)
Chrysler Corp. (Mich.)
Cofax Corp., The (N.Y.)
Cordo Chemical Corp. (Conn.)
Darling & Company (Ill.)
Dewey & Almy Chemical Co. (Mass.)
Dominion Rubber Co., Ltd. (Quebec, Canada)
Durez Plastics & Chemicals, Inc. (New York)
Durite Plastics, Inc. (Pa.)
Findley, F. G. Co. (Wis.)
Furane Plastics & Chemicals Co. (California)
General Cement Mfg. Co. (Ill.)
General Mills, Inc. (Minn.)
Goodrich, B. F. Co. (Ohio)
Goodyear Tire & Rubber Co. (Ohio)
Great American Color Co. (Calif.)
Hercules Powder Co. (Del.)
Heribert, Herbert J. (N.Y.)
Hull Iron & Steel Foundries, Ltd. (Quebec, Canada)
Interlake Chemical Corp. (Ohio)
Interlake Fibre Board Ltd. (Quebec, Canada)
Laucks, Laboratories, Inc. (Wash.)
Lifetime Plastic Inc. (Colo.)
Lithgow, James Co. (Calif.)
Marblette Corp., (N.Y.)
Marbon Corp. (Ind.)
Maskite Adhesive Co. (Calif.)
Meredith, Simmons & Co., Ltd. (Ontario, Canada)
Miracle Adhesives Corp. (N.J.)
Mystik Adhesive Products (Ill.)
National Adhesives (N.Y.)
Naugatuck Chemical Div. (N.Y.)
Paisley Products, Inc. (Ill.)
Pennsylvania Coal Products Company (Pennsylvania)
Pennsylvania Industrial Chemical Corp. (Pennsylvania)
Pennsylvania Salt Mfg. Co. (Pa.)
Perkins Glue Co. of Canada Ltd. (Ontario, Canada)
Pierce & Stevens, Inc. (N.Y.)
Plaskon Div., Libbey-Owens-Ford Glass Co. (Ohio)
Plastex Adhesive Products, Inc. (New York)
Plastic Dye & Color Co. (Md.)
Plastite Adhesive Cement Co. (Ill.)
Reichbold Chemicals, Inc. (Mich.)
Resinous Products & Chemical Co. (Pennsylvania)
Schwartz Chemical Co. (N.Y.)
Shawinigan Products Corp. (N.Y.)
Sylvan Plastics, Inc. (N.Y.)
Syntbetic Resins Ltd. (Ont., Can.)
Synvar Corporation (Del.)
Testworth Laboratorics, Inc. (Ill.)
Texon Industrial Corp. (N.Y.)
Union Bay State Co. (Mass.)
U. S. Industrial Chemicals, Inc. (New York)
United States Plywood Corp. (N.Y.)
Varcum Chemical Corp. (N.Y.)

CALENDERING

Bortman Plastics Co. (Mass.)
Firestone Industrial Products Co. (Ohio)
Goodrich, B. F. Co. (Ohio)
Respro, Inc. (R.I.)

CASTING RESINS

Adbere, Incorporated (Calif.)
Art Plastic Company (N.Y.)
Baker Oil Tools, Inc. (Calif.)
Bischoff, Ernst Co., Inc. (N.Y.)
Duorite Plastic Industries (Calif.)
Durez Plastics & Chemicals, Inc. (New York)
Marblette Corporation (N.Y.)
Poly Resins (Calif.)
Pyroxylin Products, Inc. (Ill.)
Rezolin Company, The (Calif.)
Tennessee Eastman Corp. (Tenn.)

CHEMICALS

ACCELERATORS

Aldehyde ammonia
Niacet Chemicals Division (N.Y.)

Hexamethylenetetramine
Baker, J. T. Chemical Co. (N.J.)
Burnet Company, The (N.Y.)
City Chemical Corp. (N.Y.)
du Pont, E. I. de Nemours & Co., Inc., Electrochemicals Dept. (Del.)
Heyden Chemical Corp. (N.Y.)
Mallinckrodt Chemical Works (Mo.)
Merck & Co., Inc. (N.J.)
Witco Chemical Co., Inc. (N.Y.)

Potassium hydroxide
Baker, J. T. Chemical Co. (N.J.)

Sodium hydroxide
Baker, J. T. Chemical Co. (N.J.)

Miscellaneous
Advance Solvents & Chemical Corp. (Illinois)
Fisher Scientific Co. (Pa.)
Interlake Chemical Corp. (Ohio)
Kraft Chemical Co. (Ill.)
Pennsylvania Coal Prod. Co. (Pa.)
Synvar Corporation (Del.)

BASIC (for producing plastics)

Acetaldehyde
Cities Service Oil Co. (Okla.)
General Chemical Company (N.Y.)
Niacet Chemicals Div. (N.Y.)

Acetic Acid
Chemical Manufacturing Co. (N.Y.)
City Chemical Corp. (N.Y.)
General Chemical Company (N.Y.)
Merck & Co., Inc. (N.J.)
Phillips & Jacobs (Pa.)
Shawinigan Products Corp. (N.Y.)

Acetic anhydride
American Cyanamid & Chemical Co. (New York)
Baker, J. T. Chemical Co. (N.J.)
Carbide & Carbon Chemicals Corp. (New York)
Ciba Co., Inc. (N.J.)
City Chemical Corp. (N.Y.)
Hummel Chemical Co., Inc. (N.Y.)
Mallinckrodt Chemical Works (Mo.)
Maxim Chemical Co., Inc. (N.Y.)
Merck & Co., Inc. (N.J.)
Phillips & Jacobs (Pa.)

Acetone
Baker, J. T. Chemical Co. (N.J.)
Carbide & Carbon Chemicals Corp (New York)
du Pont, E. I. de Nemours & Co., Inc., Electrochemicals Dept. (Del.)
Lotte Chemical Co., Inc. (N.J.)
Monsanto Chemical Co. Everett Div. (Mass.)
Monsanto Chemical Co. St. Louis Div. (Mo.)
Stoney-Mueller, Inc. (N.J.)

Acetylene
City Chemical Corp. (N.Y.)
Dow Chemical Co., The (Mich.)

Adipic acid
City Chemical Corp. (N.Y.)
du Pont, E. I. de Nemours & Co., Inc., Ammonia Dept. (Del.)
Hummel Chemical Co., Inc. (N.Y.)

[CHEMICALS, BASIC] Cont.
Alkanol pyridine
Reilly Tar & Chemical Corp. (Ill.)

Alkylnapthalene
Sharples Chemicals, Inc. (Pa.)

Alkylphenol
Sharples Chemicals, Inc. (Pa.)

Alkylurea
Sharples Chemicals, Inc. (Pa.)

Allyl alcohol
Carbide & Carbon Chemicals Corp. (New York)
City Chemical Corp. (N.Y.)
Fairmount Chemical Co., Inc. (N.J.)
Hummel Chemical Co., Inc. (N.Y.)
Merck & Co., Inc. (N.J.)

Aluminum stearate
Bendix Chemical Corp. (N.Y.)
Burnet Company, The (N.Y.)
Mallinckrodt Chemical Works (Mo.)

Aluminum sulfate
General Chemical Company (N.Y.)

Azeloic acid
Emery Industries, Inc. (Ohio)

Benzaldehyde
Baker, J. T. Chemical Co. (N.J.)
City Chemical Corporation (N.Y.)
Heyden Chemical Corporation (N.Y.)
Merck & Co., Inc. (N.J.)
National Aniline Division Allied Chem. & Dye Corp. (N.Y.)
N.Y. Quinine & Chemical Works, Inc. (New York)
Phillips & Jacobs (Pa.)

Benzene
American Cyanamid Company Calco Chemical Division (N.J.)
Arnold, Hoffman & Co., Inc. (R.I.)
Baker, J. T. Chemical Co. (N.J.)
Barrett Division, The Allied Chem. & Dye Corp. (N.Y.)
City Chemical Corporation (N.Y.)
Hercules Powder Company (Del.)
Koppers Company (Pa.)
Kraft Chemical Company (Ill.)
Mallinckrodt Chemical Works (Mo.)
Merck & Co., Inc. (N.J.)
Neville Company, The (Pa.)
N.Y. Quinine & Chem. Works (N.Y.)
Phillips & Jacobs (Pa.)
Stoney-Mueller, Incorporated (N.J.)
Witco Chemical Co. (N.Y.)

Benzoic acid
Heyden Chemical Corp. (Ill.)
Monsanto Chemical Company St. Louis Div. (Mo.)

Benzol
Barrett Division, The (N.Y.)
Allied Chemical & Dye Corp.

Butadiene
Carbide and Carbon Chemicals Corp. (New York)
Dow Chemical Company, The (Mich.)

Butane
Carbide and Carbon Chemicals Corp. (New York)
Hall, C. P. Company, The (Ohio)

Butyl acetate
City Chemical Corporation (N.Y.)
U.S. Industrial Chemicals (N.Y.)

Butyric acid
Baker, J. T. Chemical Co. (N.J.)
Carbide and Carbon Chemicals Corp. (New York)
City Chemical Corporation (N.Y.)
Merck & Co., Inc. (N.J.)
Phillips & Jacobs (Pa.)

Butyric anhydride
Carbide and Carbon Chemicals Corp. (New York)

Calcium acetate
General Chemical Company (N.Y.)

Calcium carbide
Baker, J. T. Chemical Co. (N.J.)
City Chemical Corporation (N.Y.)
Pacific Carbide & Alloys Co. (Calif.)
Phillips & Jacobs (Pa.)
Shawinigan Products Corp. (N.Y.)

[CHEMICALS, BASIC] Cont.
Carbon dioxide
Mathieson Alkali Works, Inc. (N.Y.)
Monsanto Chemical Company Everett Div. (Mass.)
Monsanto Chemical Company St. Louis Div. (Mo.)

Carbon monoxide
Phillips & Jacobs (Pa.)

Casein
American Cyanamid & Chemical Co. (New York)
Casein Company of America (N.Y.)
Hercules Powder Company (Del.)
Kraft Chemical Company (Ill.)
Merck & Co., Inc. (N.J.)
Phillips & Jacobs (Pa.)

Castor oil
(see Ricinoleic acid)

Catichol
Pennsylvania Coal Prod. Co. (Pa.)

Caustic soda
Pennsylvania Salt Mfg. Co. (Pa.)
Stauffer Chemical Co. (N.Y.)

Cellulose
Chemical Manufacturing Co. (N.Y.)
Hercules Powder Company (Del.)
Procter & Gamble Co., The (Ohio)
Southern Chem. Cotton Co. (Tenn.)

Cellulose acetate
Hercules Powder Co., Inc. (Del.)

Cellulose acetate flake
Flock Manufacturing Co. (N.Y.)
Mecum, Clarke W. (N.Y.)

Cellulose acetate (high acetyl)
Hercules Powder Co. (Del.)

Cellulose nitrate
Hercules Powder Co. (Del.)

Cellulose triacetate
Hercules Powder Co. (Del.)

Chlorine
American Cyanamid & Chemical Co. (New York)
Diamond Alkali Company (Pa.)
Hooker Electrochemical Co. (N.Y.)
Mathieson Alkali Works, Inc. (N.Y.)
Monsanto Chemical Company St. Louis Div. (Mo.)
Niagara Alkali Company (N.Y.)
Pennsylvania Salt Mfg. Co. (Pa.)
Pittsburgh Plate Glass Co. (Pa.)
Solvay Sales Corp. (N.Y.)
Stauffer Chemical Co. (N.Y.)
Westvaco Chlorine Products Corp. (New York)

Chlorohydrin
Carbide and Carbon Chemicals Corp. (New York)
City Chemical Corporation (N.Y.)

Cotton flock
(see Chemicals—Fillers)

Cotton linters
(see Cellulose)

Coumarone
Barrett Division, The Allied Chemical & Dye Corp. (N.Y.)
City Chemical Corporation (N.Y.)
Neville Company, The (Pa.)

Coumarone-Indene
Neville Co., The (Pa.)

Cresol
American Cyanamid Co., Calco Chemical Division (N.J.)
Barrett Division, The Allied Chemical & Dye Corporation (N.Y.)
Burnet Company, The (N.Y.)
Koppers Company, The (Pa.)
Merck & Co., Inc. (N.J.)
Monsanto Chemical Company, St. Louis Div. (Mo.)
Reilly Tar & Chemical Corp. (Ind.)

Cresylic acid
Barrett Division, The Allied Chemical & Dye Corporation (N.Y.)
Koppers Co., Inc. (Pa.)
Oronite Chemical Company (Calif.)
Reilly Tar & Chemical Corp. (Ind.)

EXTRUDED VINYLS

Any Shape, Width or Color

We extrude them in flat or paneled strips or in novelty designs, in all widths up to 4". Extruded tubes up to 1" diameter. Seven colors as well as clear.

Ask for samples. See for yourself the superior finish we impart to these long-wearing, economical materials that have such a wide variety of uses.

YARDLEY *Plastics Co.*

142 PARSONS AVE. COLUMBUS 15, OHIO

Extruders of SARAN, CELLULOSE ACETATE, BUTYRATE, POLYSTYRENE, STYRALLOY and VINYLS. Also Injection and Compression Molding

[CHEMICALS, BASIC] Cont.

Crotonaldehyde
Carbide and Carbon Chemicals (New York)
City Chemical Corporation (N.Y.)
Niacet Chemicals Division (N.Y.)

Crotonic acid
City Chemical Corporation (N.Y.)
Shawinigan Products Corp. (N.Y.)

Cyclopentadiene
City Chemical Corporation (N.Y.)
Koppers Company, Inc. (Pa.)

Dipentene
City Chemical Corporation (N.Y.)
du Pont, E. I. de Nemours & Co., Inc., Organic Chemical Dept. (Del.)
Harshaw Chemical Co. The (Ohio)
Hercules Powder Company (Del.)
Kraft Chemical Company (Ill.)
Phillips & Jacobs (Pa.)

Ethyl cellulose
Hercules Powder Company (Del.)

Ethyl chloride
City Chemical Corporation (N.Y.)
Dow Chemical Company, The (Mich.)
du Pont, E. I. de Nemours & Co., Inc., Electrochemicals Dept. (Del.)
Merck & Co., Inc. (N.J.)

Ethyl sulphate
Carbide and Carbon Chemicals Corp. (New York)
City Chemical Corporation (N.Y.)
U. S. Industrial Chemicals, Inc. (New York)

Ethylene
Carbide and Carbon Chemicals Corp. (New York)
U. S. Industrial Chemicals, Inc. (New York)
Westvaco Chlorine Products Corp. (New York)

Ethylene chlorhydrin
Carbide and Carbon Chemicals Corp. (New York)
City Chemical Corporation (N.Y.)

Ethylene glycol
Carbide and Carbon Chemicals Corp. (New York)
Dow Chemical Co. The (Mich.)
du Pont, E. I. de Nemours & Co., Inc., Ammonia Dept. (Del.)
Kraft Chemical Company (Ill.)
Phillips & Jacobs (Pa.)
U. S. Industrial Chemicals, Inc. (New York)

Ethylene oxide
Carbide and Carbon Chemicals Corp. (New York)
City Chemical Corporation (N.Y.)
Dow Chemical Co., The (Mich.)

Formaldehyde
American Cyanamid & Chemical Corp. (New York)
Burnet Company, The (N.Y.)
Chemical Manufacturing Co. (Ill.)
Cities Service Oil Co. (Okla.)
City Chemical Corporation (N.Y.)
du Pont, E. I. de Nemours & Co., Inc., Electrochemicals Dept. (Del.)
Heyden Chemical Corp. (N.Y.)
Kay Fries Chemicals, Inc. (N.Y.)
Kraft Chemical Company (Ill.)
Merck & Co., Inc. (N.J.)
Phillips & Jacobs (Pa.)

Fumaric acid
Pfizer, Chas. & Co., Inc. (N.Y.)

Furfuryl alcohol
Quaker Oats Co., The (Ill.)

Glycerin
Procter & Gamble Co., The (Ohio)

Glycerol
Armour and Company (Ill.)
Baker, J. T. Chemical Co. (N.J.)
Burnet Company, The (N.Y.)
Century Stearic Acid Candle Works (New York)
City Chemical Corporation (N.Y.)
Darling & Company (Ill.)
du Pont, E. I. de Nemours & Co., Inc., Grasselli Chemicals Department (Del.)
Emery Industries, Inc. (Ohio)
Harshaw Chemical Company, The (Ohio)
Kraft Chemical Company (Ill.)
Mallinckrodt Chemical Works (Mo.)
Merck & Co., Inc. (N. J.)
N. Y. Quinine & Chemical Works (New York)
Philipp Brothers, Inc. (N.Y.)
Phillips & Jacobs (Pa.)
Procter & Gamble Co. The (Ohio)
Reichhold Chemicals, Inc. (Mich.)
Witco Chemical Co. (N.Y.)

Hydrochloric acid
American Cyanamid & Chemical (New York)
Baker, J. T. Chemical Co. (N.J.)
Ciba Co., Inc. (N.Y.)
City Chemical Corporation (N.Y.)
Diamond Alkali Company (Pa.)
Dow Chemical Co., The (Mich.)
du Pont, E. I. de Nemours & Co., Inc., Grasselli Chemicals Department (Del.)
General Chemical Company (N.Y.)
Harshaw Chemical Co., The (Ohio)
Hercules Powder Company (Del.)
Hooker Electrochemical Co. (N.Y.)
Mallinckrodt Chemical Works (Mo.)
Merck & Co., Inc. (N.J.)
Monsanto Chemical Company, St. Louis Div. (Mo.)
Niagara Alkali Company (N.Y.)
Phillips & Jacobs (Pa.)
Rohm & Haas Company (Pa.)
Sharples Chemicals, Inc. (Pa.)
Stauffer Chemical Company (N.Y.)

Hydrofluoric acid
General Chemical Company (N.Y.)

Hydrofuramide
Quaker Oats Company (Ill.)

Isobutane
Carbide and Carbon Chemicals Corp. (New York)

Isobutyric acid
City Chemical Corporation (N.Y.)
du Pont, E. I. de Nemours & Co., Inc., Ammonia Dept. (Del.)

Lauroyl chloride
Emulsol Corporation, The (Ill.)

Linoleic acid
Armour and Company (Ill.)
Century Stearic Acid Candle Works (New York)
City Chemical Corporation (N.Y.)
Harshaw Chemical Co., The (Ohio)
Hummel Chemical Co., The (N.Y.)
Phillips & Jacobs (Pa.)

Maleic acid
American Cyanamid & Chemical Co. (New York)
Carbide and Carbon Chemicals Corp. (New York)
National Aniline Division, Allied Chemical & Dye Corp. (N.Y.)

Maleic anhydride
Carbide and Carbon Chemicals Corp. (New York)
Monsanto Chemical Company, St. Louis Div. (Mo.)

Melamine
American Cyanamid & Chemical Co. (New York)

Methyl alcohol
Baker, J. T. Chemical Co. (N.J.)
Carbide and Carbon Chemicals Corp. (New York)
City Chemical Corporation (N.Y.)
du Pont, E. I. de Nemours & Co., Inc., Ammonia Dept. (Del.)
du Pont, E. I. de Nemours & Co., Inc., Electrochemicals Dept. (Del.)
Harshaw Chemical Co., The (Ohio)
Hercules Powder Company (Del.)
Mallinckrodt Chemical Works (Mo.)
Merck & Co., Inc. (N.J.)
N. Y. Quinine & Chemical Works (New York)
Stoney-Mueller, Inc. (N.J.)

Methylene chloride
City Chemical Corporation (N.Y.)

Methylene disalicylic acid
Heyden Chemical Corp. (N.Y.)

Methyl methacrylate monomer
American Resinous Chemicals Corp. (Mass.)

Methylphloroglucinol
Edwal Laboratories, Inc., The (Ill.)

Naphtha
Barrett Division, The Allied Chemical & Dye Corp. (New York)
Velsicol Corp. (Ill.)

Naphthalene
American Cyanamid & Chemical Co. (New York)
Baker, J. T. Chemical Co. (N.J.)
Barrett Division, The Allied Chemical & Dye Corp. (New York)
City Chemical Corporation (N.Y.)
Koppers Company, Inc. (Pa.)
Merck & Co., Inc. (N.J.)
Monsanto Chemical Company, St. Louis Div. (Mo.)
Reilly Tar & Chemical Corp. (Ind.)
Velsicol Corp. (Ill.)

Nitric acid
General Chemical Company (N.Y.)

Nitrobenzene
American Cyanamid Company, Calco Chemical Division (N.J.)
Baker, J. T. Chemical Co. (N.J.)
Merck & Co., Inc. (N.J.)
National Anilene Division Allied Chemical & Dye Corp. (N.Y.)

Nitrocellulose
General Chemical Company (N.Y.)
Hercules Powder Co. (Del.)

Nitrogen
Linde Air Products Co., The (N.Y.)

Oleyl chloride
Emulsol Corporation, The (Ill.)

Oxalic acid
General Chemical Company (N.Y.)

Oxygen
Linde Air Products Co., The (N.Y.)

Para ethylphenol
Reilly Tar & Chemical Corp. (Ind.)

[CHEMICALS, BASIC] Cont.

Paraformaldehyde
du Pont, E. I. de Nemours & Co., Inc., Electrochemicals Dept. (Del.)
Heyden Chemical Corp. (N.Y.)

Paraldehyde
Niacet Chemicals Division (N.Y.)
Oronite Chemical Co. (Calif.)

Pelargonic acid
Emery Industries, Inc. (Ohio)

Pent-acetate
Sharples Chemicals, Inc. (Pa.)

Pentacrythritol
Heyden Chemical Corp. (Ill.)

Pentaerythritol
Heyden Chemical Corp. (N.Y.)

Pentasol
Sharples Chemicals, Inc. (Pa.)

Phenol
Barrett Division, The Allied Chemical & Dye Corp. (New York)
Burnet Company, The (N.Y.)
Chemical Manufacturing Co. (N.Y.)
City Chemical Corporation (N.Y.)
Dow Chemical Co., The (Mich.)
Koppers Company, Inc. (Pa.)
Kraft Chemical Company (Ill.)
Merck & Co., Inc. (N.J.)
Monsanto Chemical Company, St. Louis Div. (Mo.)
Oronite Chemical Company (Calif.)
Phillips & Jacobs (Pa.)
Reichhold Chemicals, Inc. (Mich.)
Reilly Tar & Chemical Corp. (Ind.)

Phthalic anhydride
American Cyanamid & Chemical Co. (New York)
Barrett Division, The Allied Chemical & Dye Corp. (New York)
Monsanto Chemical Company, St. Louis Div. (Mo.)
Oronite Chemical Co. (Calif.)

Phthalyl chloride
Monsanto Chemical Company, St. Louis Div. (Mo.)

Polyvinyl formal
Shawinigan Products Co. (N.Y.)

Propylene
Carbide and Carbon Chemicals Corp. (New York)

Pyridine
Reilly Tar & Chemical Corp. (Ind.)

Rennet casein
National Casein Sales (Ill.)

Resorcin
Pennsylvania Coal Prod. Co. (Pa.)

Ricinoleic acid
Amecco Chemicals, Inc. (N.Y.)
Baker Castor Oil Co., The (N.Y.)
Beacon Company, The (Mass.)
Century Stearic Acid Candle Works (New York)
City Chemical Corporation (N.Y.)

Salicylic acid
Heyden Chemical Corp. (N.Y.)

Sebacic acid
Amecco Chemicals, Inc. (N.Y.)
City Chemical Corporation (N.Y.)
Fairmount Chemical Co., Inc. (N.J.)
Hardesty Chemical Co., Inc. (N.Y.)
Hummel Chemical Co., Inc. (N.Y.)
Resinous Products & Chemical Co. (Pennsylvania)

Silicon tetrachloride
Stauffer Chemical Co. (N.Y.)

Sodium bi-sulfate
General Chemical Company (N.Y.)

Sodium cyanide
American Cyanamid & Chemical (New York)
Baker, J. T. Chemical Co. (N.J.)
City Chemical Corporation (N.Y.)
du Pont, E. I. de Nemours & Co., Inc., Electrochemicals Dept. (Del.)
Harshaw Chemical Co., The (Ohio)
Hummel Chemical Co., Inc. (N.Y.)
Mallinckrodt Chemical Works (Mo.)
Merck & Co., Inc. (N.J.)
Philipp Brothers, Inc. (N.Y.)
Phillips & Jacobs (Pa.)

Sodium hydroxide
Diamond Alkali Company (Pa.)
Dow Chemical Co., The (Mich.)
Hooker Electrochemical Co. (N.Y.)
Niagara Alkali Company (N.Y.)
Pittsburgh Plate Glass Co. (Pa.)
Solvay Sales Corp. (N.Y.)
Westvaco Chlorine Products Corp. (New York)

Stearoyl chloride
Emulsol Corporation, The (Ill.)

Styrene
Barrett Division, The Allied Chemical & Dye Corp. (New York)
City Chemical Corporation (N.Y.)
Dow Chemical Co., The (Mich.)
Monsanto Chemical Company, St. Louis Div. (Missouri)
Newport Industries, Inc. (N.Y.)

Sulfuric acid
General Chemical Company (N.Y.)
Stauffer Chemical Co. (N.Y.)

[CHEMICALS, BASIC] Cont.

Thiourea
American Cyanamid & Chemical Co. (New York)
Merck & Co., Inc. (N.J.)
Monsanto Chemical Company, St. Louis Div. (Missouri)

Titanium tetrachloride
Stauffer Chemical Co. (N.Y.)

Toluol
Barrett Division, The Allied Chemical & Dye Corporation (N.Y.)

Triaminotoluene
Edwal Laboratories, Inc., The (Ill.)

Ural
Glyco Products Co., Inc. (N.Y.)

Urea
American Cyanamid & Chemical Co. (New York)
Baker, J. T. Chemical Co. (N.J.)
City Chemical Company (N.Y.)
Harshaw Chemical Co., The (Ohio)
Phillips & Jacobs (Pa.)

Vinyl acetate
Glyco Products Co., Inc. (N.Y.)
Niacet Chemicals Div. (N.Y.)

Vinsol
Hercules Powder Co. (Del.)

Wood chips
Connor Lumber & Land Co. (Wis.)

Xylenol
Barrett Division, The Allied Chemical & Dye Corp. (New York)
Koppers Co., Inc., Tar & Chemical Div. (Pennsylvania)
Reilly Tar & Chemical Corp. (Ind.)

Miscellaneous
American Resinous Chemicals Corp. (Massachusetts)
Connecticut Hard Rubber Company (Connecticut)
Darling & Company (Ill.)
Emulsol Corporation, The (Ill.)
Heyden Chemical Corp. (N.Y.)
Koppers Co., Inc., Tar & Chemical Div. (Pennsylvania)
Procter & Gamble Co., The (Ohio)

BINDERS & EXTENDERS

Alkyd
Colasta Company, Inc., The (N.Y.)

Alkyl
Alkydol Laboratories, Inc. (Ill.)

Alkylurea derivative
Sharples Chemicals, Inc. (Pa.)

Aluminum stearate
Plymouth Organic Labs., Inc. (N.Y.)

Aniline formaldehyde
Ciba Products Corporation (N.J.)

Asphalt
Allied Asphalt & Mineral Corp. (New York)
Barrett Division, The Allied Chem. & Dye Corp. (N.Y.)
City Chemical Corporation (N.Y.)
Hall, C. P. Company, The (Ohio)
Hercules Power Company (Del.)
Kraft Chemical Company (Ill.)
Phillips & Jacobs (Pa.)
Witco Chemical Co. (N.Y.)

Asphaltite
Barber Asphalt Corporation (N.J.)

Barium stearate
Plymouth Organic Labs., Inc. (N.Y.)

Black iron oxide
Oppenheimer, Alan D., Inc. (N.Y.)

Calcium stearate
Plymouth Organic Labs., Inc. (N.Y.)

Castor oil
Arnold, Hoffman & Co., Inc. (R.I.)
Baker Castor Oil Co., The (N.Y.)
Chemical Manufacturing Co. (N.Y.)
Hercules Powder Company (Del.)
Maxim Chemical Co., Inc. (N.Y.)
Phillips & Jacobs (Pa.)
Witco Chemical Co. (N.Y.)

Coal tar pitch
American Firstoline Corp. (N.Y.)
Barrett Division, The Allied Chem. & Dye Corp. (N.Y.)
Chemical Manufacturing Co. (N.Y.)
City Chemical Corporation (N.Y.)
Koppers Company, Inc. (Pa.)
Los Angeles Chemical Co. (Calif.)
Reilly Tar & Chemical Corp. (Ind.)

Copal
American Cyanamid & Chemical Co. (New York)
City Chemical Corporation (N.Y.)
Phillips & Jacobs (Pa.)
Reichhold Chemicals, Inc. (Mich.)

Corn & soy products
Staley, A. E. Mfg. Co. (Ill.)

Cumar
Barrett Division, The (N.Y.)
Allied Chemical & Dye Corporation

Dammar
American Cyanamid & Chemical Co. (New York)
City Chemical Corporation (N.Y.)
Kraft Chemical Company (Ill.)

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- X-Ray Equipment Parts
- Measuring Cups and Spoons
- Religious Articles
- Kitchen Utensil Parts
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- Fishing Tackle
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- Compacts
- Electrical Appliance Parts
- Handles
- Razor Handles and Parts
- Aircraft Parts
- Automotive Hardware and Parts
- Dials
- Fire Extinguishing Parts
- Toys
- Washing Machine Parts
- ...ments
- Television and Telephone Parts
- ...etic Specialties
- Photographic Equipment
- ...an Blind Parts
- Filing Cabinet Hardware
- ...Equipment
- Bath Fixtures
- ...ardware
- Cooking Utensil

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CUSTOM M MOLDERS

DEXTER, MICHIGAN

Ester gum
American Cyanamid & Chemical Co. (New York)
City Chemical Corporation (N.Y).
Hercules Powder Company (Del.)
Kraft Chemical Company (Ill.)
Reichhold Chemicals, Inc. (Mich.)

Furyl alcohol
City Chemical Corporation (N.Y.)
Kraft Chemical Company (Ill.)

Gilsonite
Allied Asphalt & Mineral Corporation (New Jersey)
Barber Asphalt Corporation (N.J.)
Harshaw Chemical Co., The (Ohio)
Kraft Chemical Company (Ill.)
Phillips & Jacohs (Pa.)
Witco Chemical Co. (N.Y.)

Glycarol asters
City Chemical Corporation (N.Y.)
Emulsol Corporation, The (Ill.)
Glyco Products Co., Inc. (N.Y.)
Stresen-Reuter, Fred'k A., Inc. (Ill.)

Glycerol phthalate
City Chemical Corporation (N.Y.)
Glyco Products Co., Inc. (N.Y.)
Stresen-Reuter, Fred'k A., Inc. (Ill.)

Hardwood pitch
Allied Asphalt & Mineral Corp. (N.J.)

Indene
Barrett Division, The Allied Chem. & Dye Corp. (N.Y.)
City Chemical Corporation (N.Y.)
Neville Company, The (Pa.)

Limastone
Carbola Chemical Co., Inc. (N.Y.)

Maleic anhydride
American Cyanamid & Chemical Co. (New York)
Barrett Division, The Allied Chem. & Dye Corp. (N.Y.)
Carhide and Carbon Chemicals Corp. (New York)
City Chemical Corporation (N.Y.)
Kraft Chemical Company (Ill.)
Monsanto Chemical Company Everett Div. (Mass.)
Monsanto Chemical Company St. Louis Div. (Mo.)
National Aniline Div. Allied Chem. & Dye Corp. (N.Y.)
Phillips & Jacohs (Pa.)

Mica
Concord Mica Corporation (N.H.)
Mineralite Sales Corp. (N.Y.)

Paraldahyde
Baker, J. T. Chemical Co. (N.J.)
City Chemical Corporation (N.Y.)
Merck & Co., Inc. (N.J).
N.Y. Quinine & Chem. Works (N.Y.)
Niacet Chemicals Div. (N.Y.)

Phenol formaldahyde
Alkydol Laboratories, Inc. (Ill.)
Colasta Company, Inc., The (N.Y.)
Kraft Chemical Co. (Ill.)
Reichhold Chemicals, Inc. (Mich.)

Piccolastic
Standard Chemical Co. (Ohio)

Piccolyta
Standard Chemical Co. (Ohio)

Piccoumaron
Standard Chemical Co. (Ohio)

Rosin
City Chemical Corporation (N.Y.)
Hercules Powder Company (Del.)
Kraft Chemical Company (Ill.)
Phillips & Jacobs (Pa.)

Shallac
Burnet Company, The (N.Y.)
City Chemical Corporation (N.Y).
Harshaw Chemical Company (Ohio)
Kraft Chemical Company (Ill.)
Phillips & Jacobs (Pa.)

Miscellaneous
Allied Asphalt & Mineral Corp. (New Jersey)
Chemical Plastics, Inc. (Minn.)
Dispersions Process, Inc. (N.Y.)
Dow Corning Corporation (Mich.)
Furane Plastics & Chemicals Co. (California)
Garfield Manufacturing Co. (N.J.)
Interlake Chemical Corp. (Ohio)
Irvington Varnish & Insulator Co. (New Jersey)
Paisley Products, Inc. (Ill.)
Polyplastex (N.Y.)
Standard Chemical Co. (Ohio)

CATALYSTS

Acetyl banzoyl peroxida
Lucidol Corporation (N.Y.)

Aluminum chloride
American Cyanamid & Chemical (New York)
Ohio-Apex, Inc. (W.Va.)

Ammonia
American Cyanamid & Chemical Co. (New York)
Barrett Division Allied Chem. & Dye Corp. (N.Y.)
Colonial Chemical Co. (N.J.)
du Pont, E. I. de Nemours & Co., Inc., Ammonia Dept. (Del.)
General Chemical Company (N.Y.)
Merck & Co., Inc. (N.J.)
Monsanto Chemical Company St. Louis Div. (Missouri)
Solvay Sales Corp. (N.Y.)

Benzol peroxida
Lucidol Corporation (N.Y.)

Boron trifluoride
Harshaw Chemical Company (Ohio)

Carbon black
American Firstoline Corp. (N.Y.)
Binney & Smith Co. (N.Y.)
Burnet Company, The (N.Y.)
City Chemical Corp. (N.Y.)
Hall, C. P. Company (Ohio)
Harshaw Chemical Company (Ohio)
Kraft Chemical Company (Ill.)
Philipp Brothers, Inc. (N.Y.)
Witco Chemical Co. (N.Y.)

Chromic acid
American Firstoline Corp. (N.Y.)
Baker, J. T. Chemical Co. (N.J.)
du Pont, E. I. de Nemours & Co., Inc., Electrochemicals Dept. (Del.)
Mallinckrodt Chemical Works (Mo.)
Merck & Co., Inc. (N.J.)
N.Y. Quinine & Chemical Works (New York)

Cupric oxide
City Chemical Corporation (N.Y.)
Harshaw Chemical Company, The (Ohio)

Cuprous chloride
Baker, J. T. Chemical Co. (N.J.)
City Chemical Corporation (N.Y.)
du Pont, E. I. de Nemours & Co., Inc., Electrochemicals Dept. (Del.)
Harshaw Chemical Co., The (Ohio)
Mallinckrodt Chemical Works (Mo.)
Merck & Co., Inc. (N.J.)

Ferric chloride
American Cyanamid & Chemical (New York)
Baker, J. T. Chemical Co (N.J.)
Ciba Co., Inc. (N.Y.)
City Chemical Corporation (N.Y.)
Diamond Alkali Company (Pa.)
Dow Chemical Company, The (Mich.)
du Pont, E. I. de Nemours & Co., Inc., Electrochemicals Dept. (Del.)
Harshaw Chemical Co., The (Ohio)
Hooker Electrochemical Co. (N.Y.)
Mallinckrodt Chemical Works (Mo.)
Merck & Co., Inc. (N.J.)
Monsanto Chemical Company St. Louis Div. (Missouri)

Hydrofluoric acid, anhydrous
General Chemical Company (N.Y.)

Hydrogen peroxida
American Cyanamid & Chemical Co. (New York)
Baker, J. T. Chemical Co. (N.J.)
City Chemical Corporation (N.Y.)
du Pont, E. I. de Nemours & Co., Inc., Electrochemicals Dept. (Del.)
Harshaw Chemical Co., The (Ohio)

Iodine
Baker, J. T. Chemical Co. (N.J.)
City Chemical Corporation (N.Y.)
Dow Chemical Company, The (Mich.)
General Chemical Company (N.Y.)
Mallinckrodt Chemical Works (Mo.)
Merck & Co., Inc. (N.J.)

Iron powder
Plastic Metals, Inc. (Pa.)

Lauroyl peroxida
Lucidol Corporation (N.Y.)

Lead
American Firstoline Corp. (N.Y.)
Bendix Chemical Corporation (Pa.)
City Chemical Corporation (N.Y.)
Harshaw Chemical Co., The (Ohio)
Phillips & Jacohs (Pa.)

Lead acatate
American Cyanamid & Chemical Co. (New York)
American Firstoline Co. (N.Y.)
Baker, J. T. Chemical Co. (N.J.)
Bendix Chemical Corp. (Pa.)
du Pont, E. I. de Nemours & Co., Inc., Electrochemicals Dept. (Del.)
du Pont, E. I. de Nemours & Co., Inc., Grasseli Chem. Dept. (Del.)
General Chemical Company (N.Y.)
Harshaw Chemical Co., The (Ohio)
Hummel Chemical Co., Inc. (N.Y.)
Mallinckrodt Chemical Works (Mo.)
Merck & Co., Inc. (N.J.)
Phillips & Jacohs (Pa.)
Witco Chemical Co. (N.Y.)

Lime
City Chemical Corporation (N.Y.)
du Pont, E. I. de Nemours & Co., Inc., Grasseli Chem. Dept. (Del.)
General Chemical Company (N.Y.)
Hall, C. P. Company, The (Ohio)
Hercules Powder Company (Del.)
Phillips & Jacohs (Pa.)
Westvaco Chlorine Prod. Corp. (N.Y.)
Witco Chemical Co. (N.Y.)

Mangenase acetata
Niacet Chemicals Div. (N.Y.)

Marcury sulfate
Baker, J. T. Chemical Co. (N.J.)
City Chemical Corp. (N.Y.)
Harshaw Chemical Co., The (Ohio)
Mallinckrodt Chemical Works (Mo.)
Merck & Co., Inc. (N.J.)
N.Y. Quinine & Chem. Works (N.Y.)
Pfizer, Chas. & Co., Inc. (N.Y.)

Nickal
City Chemical Corporation (N.Y.)
du Pont, E. I. de Nemours & Co., Inc., Electrochemicals Dept. (Del.)
Harshaw Chemical Co., The (Ohio)
Hummel Chemical Co., Inc. (N.Y.)
Phillips & Jacohs (Pa.)

Nitric acid
American Cyanamid Company Calco Chemical Division (N.J.)
American Cyanamid & Chemical Co. (New York)
American Firstoline Corp. (N.Y.)
Atlas Powder Company (Del.)
Baker, J. T. Chemical Co. (N.J.)
Bendix Chemical Corp. (N.Y.)
Chemical Manufacturing Co. (N.Y.)
City Chemical Corp. (N.Y.)
du Pont, E. I. de Nemours & Co., Inc., Grasselli Chem. Dept. (Del.)
Griffin Chemical Company (Calif.)
Hercules Powder Company (Del.)
Kraft Chemical Company (Ill.)
Lotte Chemical Company, Inc. (N.J.)
Monsanto Chemical Company Everett Div. (Mass.)
Monsanto Chemical Company St. Louis Div. (Mo.)
N.Y. Quinine & Chem. Works (N.Y.)
Philipp Brothers, Inc. (N.Y.)
Phillips & Jacobs (Pa.)
Rohm & Haas Company (Pa.)
Stauffer Chemical Co., Inc. (N.Y.)

Perbenzoic acid
American Cyanamid & Chemical (New York)
American Firstoline Corp. (N.Y.)
Baker, J. T. Chemical Co. (N.J.)
City Chemical Corp. (N.Y.)
Dow Chemical Company, The (Mich.)
Harshaw Chemical Co., The (Ohio)
Mallinckrodt Chemical Works (Mo.)
Merck & Company, Inc. (N.J).
Monsanto Chemical Company St. Louis Div. (Mo.)
Phillips & Jacobs (Pa.)

Peroxide
Union Bay State Chem. Co. (Mass.)

Phosphoric acid
American Cyanamid & Chemical Co. (New York)
Chemical Manufacturing Co. (N.Y.)
City Chemical Corporation (N.Y).
Darling & Company (Ill.)
du Pont, E. I. de Nemours & Co., Inc., Electrochemicals Dept. (Del.)
du Pont, E. I. de Nemours & Co., Inc., Grasselli Chem. Dept. (Del.)
Harshaw Chemical Co., The (Ohio)
Hercules Powder Company (Del.)
Hummel Chemical Co., Inc. (N.Y.)
Kraft Chemical Company (Ill.)
Lotte Chemical Company, Inc. (N.J.)
Mallinckrodt Chemical Works (Mo.)
Maxim Chemical Co., Inc. (N.Y.)
Merck & Co., Inc. (N.J.)
Monsanto Chemical Company St. Louis Div. (Mo.)
N.Y. Quinine & Chem. Works (N.Y.)
Philipp Brothers, Inc. (N.Y.)
Phillips & Jacohs (Pa.)
Victor Chemical Works (Ill.)
Witco Chemical Co. (N.Y.)

Phosphorus oxychloride.
Ohio-Apex, Inc. (W.Va.)

Phosphorus trichloride
Ohio-Apex, Inc. (W.Va.)

Potassium
Baker, J. T. Chemical Co. (Pa.)
City Chemical Corporation (N.Y.)
du Pont, E. I. de Nemours & Co., Inc., Electrochemicals Dept. (Del.)
Fairmount Chemical Co., Inc. (N.J.)
Merck & Co., Inc. (N.J.)
Phillip & Jacobs (Pa.)

Potassium hydroxide
American Cyanamid & Chemical Co. (New York)
Baker, J. T. Chemical Co. (N.J.)
Chemical Manufacturing Co. (N.Y.)
City Chemical Corporation (N.Y.)
Colonial Chemical Company (N.J.)
Diamond Alkali Company (Pa.)
Dow Chemical Co., The (Mich.)
Merck & Co., Inc. (N.J.)
Niagara Alkali Comnany (N.Y.)
Phillips & Jacohs (Pa.)
Solvay Sales Corp. (N.Y.)
Westvaco Chlorine Products Corp. (New York)
Witco Chemical Co. (N.Y.)

Sodium
American Cyanamid & Chemical Co. (New York)
American Firstoline Corp. (N.Y.)
Arnold, Hoffman & Co., Inc. (R.I.)
Baker, J. T. Chemical Co. (N.J.)
City Chemical Corporation (N.Y.)
du Pont, E. I. de Nemours & Co. Inc., Electrochemicals Dept. (Del.)
du Pont, E. I. de Nemours & Co. Inc., Grasselli Chem. Dept. (Del.)
Harshaw Chemical Co., The (Ohio)
N. Y. Quinine & Chemical Works (New York)
Philipp Brothers, Inc. (N.Y.)
Phillips & Jacohs (Pa.)

Sodium hydroxide
American Cyanamid & Chemical Co. (New York)
Baker, J. T. Chemical Co. (N.J.)
Chemical Manufacturing Co. (N.Y.)
City Chemical Corporation (N.Y.)
Diamond Alkali Company (Pa.)
Dow Chemical Co., The (Mich.)
Phillips & Jacohs (Pa.)
Pittsburgh Plate Glass Co. (Pa.)

Sodium paroxide
Baker, J. T. Chemical Co. (N.J.)
City Chemical Corp. (N.Y.)
du Pont, E. I. de Nemours & Co., Inc., Electrochemicals Dept. (Del.)
Kraft Chemical Company (Ill.)
Mallinckrodt Chemical Works (Mo.)
Merck & Co., Inc. (N.J.)

Sodium staarate
American Firstoline Corp. (N.Y.)
Baker, J. T. Chemical Co. (N.J.)
City Chemical Corporation (N.Y.)
Harshaw Chemical Co., The (Ohio)
Mallinckrodt Chemical Works (Mo.)
Merck & Co., Inc. (N.J.)
Phillips & Jacobs (Pa.)

Stannic chloride
City Chemical Corporation (N.Y.)
Kraft Chemical Company (Ill.)

Sulfuric acid
American Cyanamid & Chemical Co. (New York)
Chemical Manufacturing Co. (N.Y.)
City Chemical Corporation (N.Y.)
Monsanto Chemical Company, St. Louis Div. (Missouri)
Philipp Brothers, Inc. (N.Y.)
U. S. Rubber Company (N.Y.)

Tertiary butyl hydroperoxide
Union Bay State Company (Mass.)

Tertiary butyl perbenzoata
Union Bay State Company (Mass.)

Toluene sulfonic acid
City Chemical Corporation (N.Y.)
Monsanto Chemical Company St. Louis Div. (Missouri)

Trimethylamine
City Chemical Corporation (N.Y.)
Rohm & Haas Company (Pa.)

Vanadium pentoxide
City Chemical Corporation (N.Y.)
Fairmont Chemical Co., Inc. (N.J.

Zinc chloride
American Cyanamid & Chemical Co. (New York)
American Firstoline Corp. (N.Y.)
Chemical Manufacturing Co. (N.Y.)
City Chemical Corporation (N.Y.)
du Pont, E. I. de Nemours & Co., Inc., Electrochemicals Dept. (Del.)
du Pont, E. I. de Nemours & Co., Inc., Grasselli Chem. Dept. (Del.)
Hummel Chemical Co., Inc. (N.Y.)
Philipp Brothers, Inc. (N.Y.)
Rohm & Haas Company (Pa.)
Witco Chemical Co. (N.Y.)

Miscellanaous
Advance Solvents & Chemical Corp. (Illinois)
Fisher Scientific Co. (Pa.)
Hooker Electrochemical (N.Y.)
Kraft Chemical Co. (Ill.)

DISPERSIONS

Dispersions Process, Inc. (N.Y.)
Goodrich, B. F. Chemical Co. (Ohio)
Procter & Gamble Co., The (Ohio)
Selectronic Dispersions, Inc. (N.J.)

FILLERS

Activated Silica
Wilson Carbon Co., Inc. (N.Y.)

Alumina hydrate
Westvaco Chlorine Products Corp. (New York)

Asbestine
Kraft Chemical Company (Ill.)

Asbastos
Burnet Company, The (N.Y.)
Carey, Philip Mfg. Co., The (Ohio)
Kraft Chemical Company (Ill.)

Asbestos fibre
Powhatan Mining Co. (Md.)
Vermont Asbestos Mines (N.Y.)

Barium hydroxide
Baker, J. T. Chemical Co. (N.J.)

Black iron oxida
Oppenheimer, Alan D., Inc. (N.Y.)

Blanc fixe
Westvaco Chlorine Products (N.Y.)

Calcium carbonate
Diamond Alkali Company (Pa.)

(Cont. on pg. 93)

Crystal SEAL

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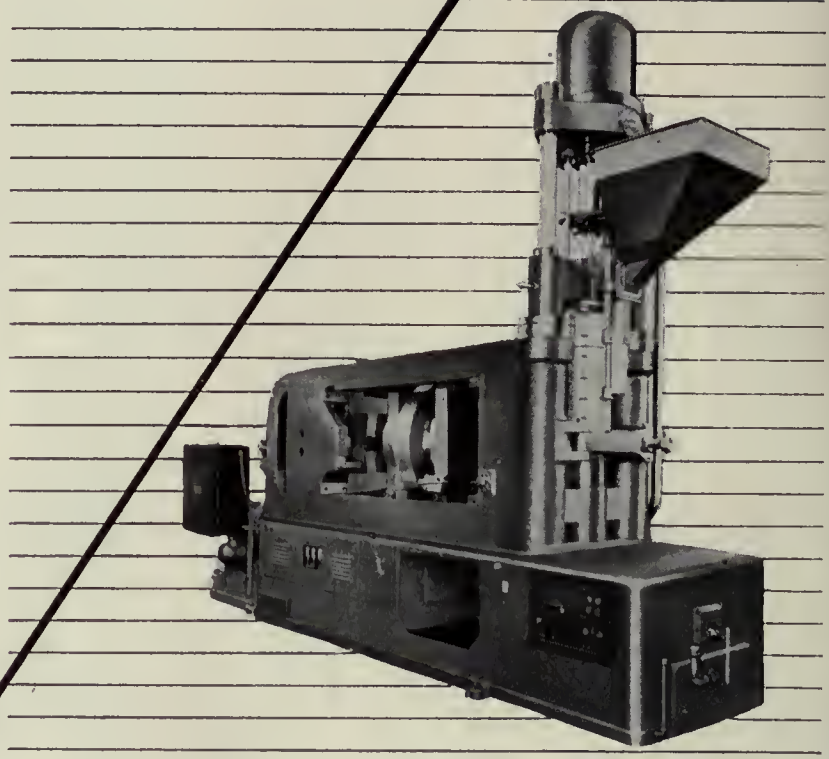
INJECTION MOLDING



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[CHEMICALS, FILLERS] Cont.

Chopped Fabric
Hock Manufacturing Co (N.Y.)

Clay
Wagner, Charles A. Co., Inc. (Pa.)

Cocoanut shells
Sirotta, Bernard Co. (N.Y.)

Cocoanut shell flour
Sirotta, Bernard Co. (N.Y.)

Cord, tire
Clipper Products Company (Pa.)

Cotton flock
Bamberger, A. (N.Y.)
Becker, Moore & Co., Inc. (N.Y.)
Burnet Company, The (N.Y.)
Canvas Specialty Co. (Conn.)
Claremont Waste Mfg. Co. (N.H.)
Composition Materials Co., Inc. (New York)
Flock Manufacturing Co. (N.Y.)
Hall Line Corporation (N.Y.)
Hercules Powder Company (Del.)
Kraft Chemical Company (Ill.)
Mecum, Clarke W. (N.Y.)
Oppenheimer, Alan D., Inc. (N.Y.)
Rayon Processing Co. of R.I. (R.I.)

Diatomaceous earth
American Cyanamid & Chemical Co. (New York)
Burnet Company, The (N.Y.)
Chemical Manufacturing Co. (N.Y.)
City Chemical Corporation (N.Y.)
Dicalite Company, The (Calif.)
Harshaw Chemical Co., The (Ohio)
Johns-Manville Sales Corp. (N.Y.)
Vitco Chemical Co. (N.Y.)

Diatomaceous silica
Dicalite Company, The (N.Y.)

Fabric
Clipper Products Company (Pa.)
Exeter Manufacturing Co. (N.Y.)
Mecum, Clarke W. (N.Y.)

Glass (Fiberglas)
Owens-Corning Fiberglas Corp. (O.)

Ground nut shells
Composition Materials Co., Inc. (New York)
Owens-Corning Fiberglas Corp. (O.)

Hard clay
Standard Chemical Co. (Ohio)

Hardwood Pitch
Cliffs Dow Chemical Co. (Mich.)

Iron Powder
Plastic Metals Div. of National Radiator Co. (Pa.)

Leather flock
Composition Materials Co., Inc. (New York)

Macerated fabric
Clipper Products Company (Pa.)
Mecum, Clarke W. (N.Y.)
Rayon Processing Co. of R. I. (R.I.)

Magnesium silicate (Talc)
Loomis, W. H. Talc Corp. (N.Y.)

Metallic decorative
Rayon Processing Co. of R. I. (R.I.)

Metallic soaps
Harshaw Chemical Co., The (O.)

Mica
Burnet Company, The (N.Y.)
Concord Mica Corporation (N.H.)
Kraft Chemical Company (Ill.)
Mineralite Sales Corp. (N.Y.)
Phillips & Jacohs (Pa.)

Nickel Powder
Plastics Metals Div. of National Radiator Co. (Pa.)

Nut shells
Sirotta, Bernard Co. (N.Y.)

Nut shell flour
Sirotta, Bernard Co. (N.Y.)

Organic fibre
Composition Materials Co., Inc. (New York)

Paper
(see Laminating Materials, p. 102)

Potato starch
Paisley Products, Inc. (Ill.)

Powdered charcoal
Cliffs Dow Chemical Co. (Mich.)

Rayon flock
Claremont Waste Mfg. Co. (N.H.)
Rayon Processing Co. of R. I. (R.I.)

Sawdust
Montreal Sawdust & Woodflour (Quehec, Canada)

Silene (Calcium silicate)
Standard Chemical Co. (Ohio)

Silicon
Plastics Metal Div. of National Radiator Co. (Pennsylvania)

Sisal shredded
Oppenheimer, Alan D., Inc. (N.Y.)

Soft clay
Standard Chemical Co. (Ohio)

Stearine pitch
Century Stearic Acid Candle Works (New York)

[CHEMICALS, FILLERS] Cont.

Talc
Carhola Chemical Co., Inc. (N.Y.)
Kraft Chemical Company (Ill.)
Loomis, W. H. Talc Corp. (N.Y.)
Wagner, Charles A. Co., Inc. (Pa.)

Talc and limestone
Carhola Chemical Co., Inc. (N.Y.)

Tapioca-potato dextrine
Paisley Products, Inc. (Ill.)

Twine
Hall Line Corporation (N.Y.)

Walnut shell flour
Agicide Laboratories, Inc. (Wis.)

Wood flour
Becker, Moore & Co., Inc. (N.Y.)
Burnet Company, The (N.Y.)
City Chemical Corporation (N.Y.)
Composition Materials Co., Inc. (New York)
Connor Lumber & Land Co., The (Wisconsin)
Kraft Chemical Company (Ill.)
Lignum Chemical Works, The (N.Y.)
Montreal Sawdust & Woodflour (Quehec, Canada)
Phillips & Jacohs (Pa.)
Wagner, Charles A. Co., Inc. (Pa.)
Wood Flour, Inc. (N.H.)

Wool flock
Claremont Waste Mfg. Co. (N.H.)
Hall, C. P. Company (Ohio)
Kessler Chemical Co., Inc. (Pa.)
Kraft Chemical Co. (Ill.)
Landers-Segal Color Co. (N.Y.)
Marathon Corp. (Wis.)

MOLD LUBRICANTS

Acrawax C.
Glyco Products Co., Inc. (N.Y.)

Aluminum stearate
Metasap Chemical Co., Inc. (N.J.)
Plymouth Organic Lahs., Inc. (N.Y.)

Barium stearate
Plymouth Organic Lahs., Inc. (N.Y.)

Blandol white mineral oil
Sonnehorn, L. Sons, Inc. (N.Y.)

Butyl stearate
Hoffman, Arnold & Co., Inc. (R.I.)
Commercial Solvents Corp. (N.Y.)

Calcium stearate
Metasap Chemical Co., Inc. (N.J.)
Plymouth Organic Lahs., Inc. (N.Y.)

Metallic soaps
Harshaw Chemical Co., The (O.)

Metallic stearates
Warwick Chemical Co. (R.I.)

Mica
Mineralite Sales Corp. (N.Y.)

Oleic Acid
Darling & Co. (Ill.)

Petronate
Sonnehorn, L. Sons, Inc. (N.Y.)

Stearic Acid
Darling & Co. (Ill.)

Stearine Pitch
Allied Asphalt & Mineral Corporation (New Jersey)

Miscellaneous
Advance Solvents & Cehmical Corp. (Illinois)
Carbide and Carhon Chemicals (New York)
Concord Mica Corporation (N.H.)
Dow Corning Corporation (Mich.)
Glyco Products Co., Inc. (N.Y.)
Hall, C. P. Company (Ohio)
Kessler Chemical Co., Inc. (Pa.)
Kraft Chemical Co. (Ill.)
Mallinckrodt Chemical Works (Mo.)
Metasap Chemical Co., Inc. (N.J.)
Monsanto Chemical Company, St. Louis Div. (Missouri)
Polyplastex (N.Y.)
Protective Coatings, Inc. (Mich.)
Procter & Gamhle Co., The (Ohio)
Warwick Chemical Company (R.I.)

PIGMENTS and DYES

Bitumen
Wilson Carbon Co., Inc. (N.Y.)

Black iron oxide
Oppenheimer, Alan D., Inc. (N.Y.)

Cadmium Lithopones
Harshaw Chemical Co., The (O.)

Cadmium Sulfides
Harshaw Chemical Co., The (O.)

Carbon Black
Binney & Smith Co. (N.Y.)
Carhon Dispersions, Inc. (N.J.)
Standard Chemical Co. (Ohio)
Uhlich, Paul & Co., Inc. (N.Y.)
United Carhon Co., Inc. (Va.)

Color Pigments
Anshacher Siegle Corp. (N.Y.)
Uhlich, Paul & Co., Inc. (N.Y.)

Oxides of Iron
Binney & Smith Co. (N.Y.)

Red iron oxide
Wagner, Charles A. Co., Inc. (Pa.)

Umber
Wagner, Charles A. Co., Inc. (Pa.)

[CHEMICALS, PIGMENTS] Cont.

Miscellaneous
Acromark Company, The (N.J.)
American Cyanamid Company, Calco Chemical Division (N.J.)
Anshacher Siegle Corp. (N.Y.)
Binney & Smith Co. (N.Y.)
Burnet Company, The (N.Y.)
Cardinal Chemical Company (N.Y.)
Ciha Co., Inc. (N.Y.)
Concord Mica Corporation (N.H.)
Diamond Alkali Company (Pa.)
Fine Colors Company, Inc. (N.J.)
General Dyestuff Corp. (N.Y.)
Great American Color Co. (Calif.)
Harshaw Chemical Company (Ohio)
Krieger Color & Chem. Co. (Calif.)
Landers-Segal Color Co. (N.Y.)
Mearl Corporation, The (N.Y.)
National Aniline Division (N.Y.)
New Jersey Zinc Sales Co., The (New York)
Plastex Adhesive Products, Inc. (New York)
Plastic Color Products (N.J.)
Plastic Dye & Color Co. (Md.)
Plastic Products Co. (Ohio)
Schwartz Chemical Co. (N.Y.)
Uhlich, Paul & Co., Inc. (N.Y.)
Wilmington Chemical Corp. (N.Y.)
Wilson Carhon Company (N.Y.)
Zinsser & Company, Inc. (N.Y.)

PIGMENTS and DYES (Luminescent), PEARL ESSENCE

American Cyanamid Co., Calco Chemical Div. (N.J.)
American Firstoline Corp. (N.Y.)
American Luminous Pro. Co. (Calif.)
American Resinous Chemicals Corp. (Massachusetts)
Bach, Leo (N.Y.)
General Luminescent Corp. (Ill.)
Ivano, Incorporated (Mass.)
Kraft Chemical Co. (Ill.)
Mearl Corporation, The (N.Y.)
New Jersey Zinc Company (N.Y.)
Rhode Island Lah., Inc. (R.I.)
Warwick Chemical Co. (R.I.)

PLASTICIZERS

Acetamide
Niacet Chemicals Div. (N.Y.)

Acetanilide
Baker, J. T. Chemical Co. (N.J.)
City Chemical Corporation (N.Y.)
du Pont, E. I. de Nemours & Co., Inc., Electrochemicals Dept. (Del.)
Mallinckrodt Chemical Works (Mo.)
Merck & Co., Inc. (N.J.)
Monsanto Chemical Company, St. Louis Div. (Mo.)
N. Y. Quinine & Chemical Works (New York)
Sherwin-Williams Co., Inc. (Ohio)

Acetyl triethyl citrate
Pfizer, Chas. & Co., Inc. (N.Y.)

Alkylaryl Phosphate
Celanese Chemical Corp. (N.Y.)

Alkylureas
Sharples Chemicals, Inc. (Pa.)

Allylethylenediamine
Evans Chemetics, Inc. (N.Y.)

Aluminum stearate
Metasap Chemical Co., Inc. (N.J.)
Plymouth Organic Lahs., Inc. (N.Y.)

Amyl esters
Kessler Chemical Co., Inc. (Pa.)
Pfizer, Chas. & Co., Inc. (N.Y.)

Amyl phthalate
City Chemical Corporation (N.Y.)
U. S. Industrial Chem., Inc. (N.Y.)

Barium stearate
Plymouth Organic Lahs., Inc. (N.Y.)

Benzaldehyde
Merck & Co, Inc. (N.J.)

Benzaphenone
American-British Chemical Supplies, Inc. (New York)
Kay-Fries Chemicals, Inc. (N.Y.)

Benzyl alcohol
Hooker Electrochemical Co. (N.Y.)

Butoxy ethyl stearate
Ohio-Apex, Inc. (W.Va.)
Stoney-Mueller, Inc. (N.J.)

Butyl benzyl sebacate
Hardesty Chemical Co., Inc. (N.Y.)

Butyl "cellosolve" phthalate
Stoney-Mueller, Inc. (N.J.)

Butyl "cellosolve" esters
Kessler Chemical Co., Inc. (Pa.)

Butyl "cellosolve" stearate
Kessler Chemical Co., Inc. (Pa.)

Butyl esters
Kessler Chemical Co, Inc. (Pa.)

Butyl laurate
Hoffman, Arnold & Co., Inc. (R.I.)
Kessler Chemical Co., Inc. (Pa.)

Butyl myristate
Hoffman, Arnold & Co., Inc. (R.I.)

[CHEM., PLASTICIZERS] Cont.

Butyl oleate
Century Stearic Acid Candle Works (New York)
City Chemical Corporation (N.Y.)
Hoffman, Arnold & Co., Inc. (R.I.)
Kessler Chemical Co., Inc. (Pa.)
National Oil Products Co. (N.J.)
Standard Chemical Co. (Ohio)

Butyl palmitate
Hoffman, Arnold & Co., Inc. (R.I.)
Standard Chemical Co. (Ohio)

Butyl phthalate
American Cyanamid & Chem. (N.Y.)
Barrett Division, The (N.Y.)
Carhide and Carhon Chem. (N.Y.)
City Chemical Corporation (N.Y.)
Kraft Chemical Company (Ill.)
Sherwin-Williams Co., The (Ohio)
Stoney-Mueller, Inc. (N.J.)

Butyl phthalyl Butyl glycolate
Monsanto Chemical Company (Mo.) St. Louis Div.

Butyl roleate
Hardesty Chemical Co., Inc. (N.Y.)

Butyl sebacate
Amecco Chemical, Inc. (N.Y.)
City Chemical Corporation (N.Y.)
Reichhold Chemicals, Inc. (Mich.)
Resinous Products & Chemicals Co. (Pennsylvania)

Butyl stearate
Kessler Chemical Co., Inc. (Pa.)
Hoffman, Arnold & Co., Inc. (R.I.)
National Oil Products Co. (N.J.)
Standard Chemical Co. (Ohio)

Calcium stearate
Beacon Company, The (Mass.)
Burnet Company, The (N.Y.)
Mallinckrodt Chem. Works (Mo.)
Metasap Chemical Co., Inc. (N.J.)
Plymouth Organic Lahs., Inc. (N.Y.)

Camphor
Chemical Manufacturing Co. (N.Y.)

Capryl alcohol
Hardesty Chemical Co., Inc. (N.Y.)

Carbitol esters
Kessler Chemical Co., Inc. (Pa.)

Cardanol
Irvington Varnish & Insulator Co. (New Jersey)

"Cellosolve" esters
Kessler Chemical Co., Inc. (Pa.)

"Cellosolve" monoricinoleate
Glyco Products Co., Inc. (N.J.)

Chlorinated diphenyl
Monsanto Chemical Company (Mo.) St. Louis Div.

Chlorinated naphthalene
Hooker Electrochemical Co. (N.Y.)

Chlorinated paraffin
Amecco Chemicals, Inc. (N.Y.)
Diamond Alkali Company (Pa.)
Hercules Powder Company (Del.)

Chlorpropane (liquid)
Hooker Electrochemical Co., (N.Y.)

Chlorpropane (wax)
Hooker Electrochemical Co., (N.Y.)

Cresol derivative
Koppers Company, Inc. (Pa.)

Cresylic acid
Burnet Company, The (N.Y.)
Koppers Company, Inc. (Pa.)
Philipp Brothers, Inc. (N.Y.)

Cyclohexanol
Barrett Division, The (N.Y.)
Allied Chemical & Dye Corp.
du Pont, E. I. de Nemours & Co., Inc. (Del.) Ammonia Department
Hooker Electrochemical Co., (N.Y.)
Rohm & Haas Company (Pa.)

Cyclohexyl esters
Kessler Chemical Co., Inc. (Pa.)

Cyclohexyl levulinate
Glyco Products Co., Inc. (N.Y.)

Cyclohexyl stearate
Barrett Division, The (N.Y.), Allied Chemical & Dye Corp.
Beacon Company, The (Mass.)
City Chemical Corporation (N.Y.)
Glyco Products Co., Inc. (N.Y.)
Kessler Chemical Co., Inc. (Pa.)

Diacetin
Kessler Chemical Co., Inc. (Pa.)

Diamyl naphthalene
Sharples Chemicals, Inc. (Pa.)

Diamyl phthalate
Stoney-Mueller, Inc. (N.J.)

Diabenzyl sebacate
Resinous Products & Chem. Co. (Pa.)

Diallyl phthalate
Ohio-Apex, Inc. (W.Va.)

Dibenzl sebacate
Hardesty Chemical Co., Inc. (N.Y.)

Dibutoxy ethyl phthalate
Covel Mfg. Co. (Michigan)
Ohio-Apex, Inc. (W.Va.)
Stoney-Mueller, Inc. (N.J.)

Dibutoxy ethyl sebacate
Hardesty Chemical Co., Inc. (N.Y.)

[CHEM., PLASTICIZERS] Cont.

Dibutyl "cellosolve" sebacete
Hoffman, Arnold & Co., Inc. (R.I.)

Dibutyl phthelate
American-British Chemical Supplies, Inc. (New York)
American Cyanamid & Chemical (New York)
Barrett Division, The (N.Y.)
Allied Chemical & Dye Corp.
Burnet Company, The (N.Y.)
Chemical Manufacturing Co. (N.Y.)
City Chemical Corp. (N.Y.)
Commereial Solvents Corp. (N.Y.)
Kay Fries Chemicals, Inc. (N.Y.)
Monsanto Chemical Co. (Mo.)
St. Louis Div.
Neville Co., The (Pa.)
Pennsylvania Alcohol & Chemical (New York)
Reichhold Chemicals, Inc. (Mich.)
Sherwin-Williams Co., The (Ohio)
Standard Chemical Co. (Ohio)
Stoney-Mueller, Inc. (N.J.)

Dibutyl sebecete
Commercial Solvents Corporation (New York)
Hardesty Chemical Co., Inc. (N.Y.)
Reichhold Chemicals, Inc. (Mich.)
Resinous Products & Chemical Co. (Pennsylvania)
Standard Chemical Co. (Ohio)

Dibutyl tartrete
Kessler Chemical Company, Inc. (Pennsylvania)

Dicepryl phthelate
Hardesty Chemical Co., Inc. (N.Y.)
Resinous Products & Chemical Co. (Pennsylvania)

Di-cerbitol phthelate
Ohio-Apex, Inc. (W.Va.)
Stoney-Mueller, Inc. (N.J.)

Diethoxy ethyl phthelete
Stoney-Mueller, Inc. (N.J.)

Diethyl edipate
Eastman Kodak Co. (N.Y.)

Diethyl phthelete
American-British Chemical Supplies, Inc. (New York)
Hercules Powder Co. (Del.)
Kay Fries Chemicals, Inc. (N.Y.)
Monsanto Chemical Co. (Mo.)
St. Louis Div.
Pennsylvania Alcohol & Chemical (New York)
Standard Chemical Co. (Ohio)
Stoney-Mueller, Inc. (N.J.)

Diethyl succinate
City Chemical Corp. (N.Y.)

Diethylene glycol
Standard Chemical Co. (Ohio)

Diethylene glycol dilectete
Glyco Products Company, Inc. (New York)

Diethylene glycol esters
Kessler Chemical Co., Inc. (Pa.)

Diethylene glycol mono laurate
Glyco Products Co., Inc. (N.Y.)

Dimethoxy ethyl phthelete
Stoney-Mueller, Inc. (N.J.)

Dimethyl glycol phthelete
Ohio-Apex, Inc. (W.Va.)

Dimethyl phthelete
American-British Chemical Supplies, Inc. (New York)
American Cyanamid & Chemical (New York)
Carbide and Carbon Chemicals (New York)
Chemical Manufaeturing Co. (N.Y.)
City Chemical Corp. (N.Y.)
Kessler Chemical Co., Inc. (Pa.)
Ohio-Apex, Inc. (W.Va.)
Reichhold Chemicals, Inc. (Mich.)
Stoney-Mueller, Inc. (N.J.)

Dioctyl sebecete
Hardesty Chemical Co., Inc. (N.Y.)

Di-(ortho xenyl) mono-phenyl phosphete
Dow Chemical Co., The (Mich.)

Di-phenyl mon-(orthoxenyl phosphete
Dow Chemical Co., The (Mich.)
Monsanto Chemical Co. (Mo.)
St. Louis Div.

Di polymer oil
Standard Chemical Company (Ohio)

Dipropylene glycol esters
Kessler Chemical Co., Inc. (Pa.)

[CHEM., PLASTICIZERS] Cont.

Esters of fatty acids
Emery Industries, Inc. (Ohio)
Kessler Chemical Co., Inc. (Pa.)

Ethyl esters
Kessler Chemical Co., Inc. (Pa.)

Ethyl phthelyl ethyl glycolete
Monsanto Chemical Co. (Mo.)
St. Louis Div.

Ethylene glycol esters
Kessler Chemical Co., Inc. (Pa.)

Furfurel
Alkydol Lahoratories, Inc. (Ill.)
Baker, J. T. Chemical Co. (N.J.)
City Chemical Corporation (N.Y.)
Quaker Oats Co., The (Ill.)

Furfurel elcohol
Quaker Oats Co., The (Ill.)

Gleurin
Glyco Products Co., Inc. (N.Y.)

Glorie white minerel oil
Sonneborn, L. Sons, Inc. (N.Y.)

Glycerin
Procter & Gamble Co., The (Ohio)

Glycerol esters
Kessler Chemical Co., Inc. (Pa.)

Glycerol ricinoleete
City Chemical Corp. (N.Y.)
Glyco Products Co., Inc. (N.Y.)
Stresen-Reuter, Fred'k A., Inc. (Ill.)

Hexechlorbenzene
Hooker Electrochemical Co. (N.Y.)

Hexechlorbutediene
Hooker Electrochemical Co. (N.Y.)

Hexechlorethene
Hooker Electrochemical Co. (N.Y.)

Hexechlorpropylene
Hooker Electrochemical Co. (N.Y.)

Hydroxy steeric ecid
Evans Chemetics, Inc. (N.Y.)

Isobutyl esters
Kessler Chemical Co., Inc. (Pa.)

Isopropyl esters
Kessler Chemical Co., Inc. (Pa.)

Isopropyl leurete
Emulsol Corporation, The (Ill.)

Isopropyl pelmitete
Emulsol Corporation, The (Ill.)

Keydel white minerel oil
Sonnehorn, L. Sons, Inc. (N.Y.)

Lectic ecid
Baker, J. T. Chemical Co. (N.J.)

Levulinic acid
Staley, A. E. Mfg. Co. (Ill.)

Megnesium stearete
Mallinckrodt Chemical Works (Mo.)

Meleic acid
Evans Chemetics Inc. (N.Y.)

Menthylphenol
Hercules Powder Co., Inc. (Del.)

Metallic soeps
Harshaw Chemical Co., The (O.)

Methoxy ethyl ecetyl ricinoleete
Ohio-Apex, Inc. (W.Va.)
Stoney-Mueller, Inc. (N.J.)

Methoxy ethyl oleete
Stoney-Mueller, Inc. (N.J.)

Methyl ecetyl ricinoleate
Baker Castor Oil Co., The (N.Y.)

Methyl benzoyl benzoete
American Cyanamid & Chem. (N.Y.)
City Chemical Corporation (N.Y.)

Methyl "cellosolve" esters
Eastman Kodak Company (N.Y.)
Glyco Products Co., Inc. (N.Y.)
Kessler Chemical Co., Inc. (Pa.)
Ohio-Apex, Inc. (W.Va.)

Methyl cyclohexenol
Hooker Electrochemical Co. (N.Y.)

Methyl dichlor stearete
Hooker Electrochemical Co. (N.Y.)

Methyl esters
Kessler Chemical Co., Inc. (Pa.)

Methyl pentechlor steerete
Hooker Electrochemical Co. (N.Y.)

Methyl "cellosolve" phthelate
Stoney-Mueller, Inc. (N.J.)

Methyl "cellosolve" steerete
Hoffman, Arnold & Co., Inc. (R.I.)
Kessler Chemical Co., Inc. (Pa.)

Methyl oleete
Standard Chemical Co. (Ohio)

Methyl phthelyl ethyl glycolete
Monsanto Chemical Company (Mo.)
St. Louis Div.

Methyl stearete
National Oil Products Co. (N.J.)
Standard Chemical Co. (Ohio)

Octyl esters
Kessler Chemical Co., Inc. (Pa.)

Oleic ecid
Amecco Chemicals, Inc. (N.Y.)
Armour and Company (Ill.)
Baker Castor Oil Co., The (N.Y.)
Century Stearic Acid Candle Works (New York)
City Chemical Corporation (N.Y.)
Darling & Company (Ill.)
Emery Industries, Inc. (Ohio)
Hummel Chemieal Co., Inc. (N.Y.)
Kessler Chemical Co., Inc. (Pa.)
Merck & Co., Inc. (N.J.)
Witco Chemical Co. (N.Y.)
Wohurn Chemical Corp. (N.J.)

o and p toluene ethyl sulfonemide
Monsanto Chemical Company (Mo.)
St. Louis Div.

o end p toluene sulfonemide
Monsanto Chemical Company (Mo.)
St. Louis Div.

Pentechlor phenyl benzoete
Hooker Electrochemical Co. (N.Y.)

Penteerythritol esters
Hercules Powder Company (Del.)

Phthalic anhydride
American Cyanamid & Chemical Corp. (N.Y.)
Baker, J. T. Chemical Co. (N.J.)
Barrett Division, Allied Chemical & Dye Corp. (N.Y.)
City Chemical Corp. (N.Y.)
Mallinckrodt Chemical Works (Mo.)
Merck & Co., Inc. (N.J.)
Monsanto Chemical Company (Mo.)
St. Louis Div.
National Aniline Division (N.Y.)
Allied Chemical & Dye Corp.
Reichhold Chemicals, Inc. (Mich.)

Picconal
Standard Chemical Co. (Ohio)

Pictor
Standard Chemical Co. (Ohio)

Polyemyl nephthalene
Sharples Chemicals, Inc. (Pa.)

Polyethylene glycol esters
Kessler Chemical Co., Inc. (Pa.)

Polyvinyl acetete
du Pont, E. I. de Nemours & Co., Inc. (Del.), Electrochemicals Dept.
Shawinigan Products Co. (N.Y.)

Propylene glycol
Standard Chemical Co. (Ohio)

Propylene glycol esters
Kessler Chemical Co., Inc. (Pa.)

Sorbitol esters
Glyco Products Co. (N.Y.)

Steeric acid
Amecco Chemicals, Inc. (N.Y.)
Armour and Co. (Ill.)
Baker Castor Oil Co., The (N.Y.)
Century Stearic Acid Candle Works (New York)
City Chemical Corp. (N.Y.)
Darling & Co. (Ill.)
Emery Industries, Inc. (Ohio)
Hummel Chemical Co., The (N.Y.)
Kessler Chemical Co., Inc. (Pa.)
Mallinckrodt Chemical Works (Mo.)
Witco Chemical Co. (N.Y.)
Wohurn Chemical Co. (N.J.)

Succinic ecid
Merck & Co., Inc. (N.J.)
National Aniline Division (N.Y.), Allied Chemical & Dye Corp.

Succinic anhydride
Merck & Co., Inc. (N.J.)
National Aniline Division (N.Y.), Allied Chemical & Dye Corp.

Sucrose octe acetete
Niacet Chemicals Div. (N.Y.)

Tetrehydrofurfuryl
Quaker Oats Co., The (Ill.)

Tetrehydrofurfuryl elcohol
Quaker Oats Co., The (Ill.)

Tetrahydrofurfuryl oleate
Glyco Products Co., Inc. (N.Y.)
Hooker Electrochemical Co. (N.Y.)

Theop
Glyco Products Co., Inc. (N.Y.)

Triaceti
Chemical Manufacturing Co. (N.Y.)
Hercules Powder Co. (Del).
Kay Fries Chemicals, Inc. (N.Y.)
Kessler Chemical Co., Inc. (Pa.)
Standard Chemical Co. (Ohio)

Tributoxy ethyl phosphate
Ohio-Apex, Inc. (W.Va.)
Stoney-Mueller, Inc. (N.J.)

Tributyl Citrete
Pfizer, Chas. & Co., Inc. (N.Y.)

Tricresyl phosphate
Celanese Plastics Corp. (N.Y.)
Chemical Mfg. Co. (N.Y.)
City Chemical Corp. (N.Y.)
Monsanto Chemical Co. (Mo.)
St. Louis Div.
Ohio-Apex, Inc. (W.Va.)
Pennsylvania Alcohol & Chemical (New York)
Stoney-Mueller Inc. (N.J.)

Triethenolemine leurete (ester)
Emulsol Corporation, The (Ill.)

Triethyl citrete
Pfizer, Chas. & Co., Inc. (N.Y.)

[CHEM., PLASTICIZERS] Cont.

Triglycol dioctoete
Carhide & Carbon Chemical Corp. (New York)

Trioctyl phosphete
Carhide and Carbon Chemicals Corp. (New York)
Westvaco Chlorine Prod. Corp. (New York)

Tri- (para tertbutylphenyl phosphete)
Dow Chemical Co., The (Mich.)

Triphenyl phosphate
Kay Fries Chemicals, Inc. (N.Y.)
Monsanto Chemical Co. (Mo.)
St. Louis Div.
Stoney-Mueller, Inc. (N.J.)

Trixylyl phosphete
Celanese Chemical Corp. (N.Y.)

Undecyl esters
Kessler Chemical Co., Inc. (Pa.)

Zinc steerete
American Firstoline Corp. (N.Y.)
Beacon Co., The (Mass.)
Bendix Chemical Corp. (N.Y.)
Mallinckrodt Chemical Works (Mo.)
Merck & Co., Inc. (N.J.)
Metasap Chemical Co., Inc. (N.J.)
Plymouth Organic Lahs., Inc. (N.Y.)

Miscelleneous
Advance Solvents & Chemical (N.Y.)
Amecco Chemicals, Inc. (N.Y.)
Baker Castor Oil Co. (N.Y.)
Carhide & Carbon Chemicals (N.Y.)
Century Stearic Acid Candle Works (New York)
Connecticut Hard Rubber Co. (Conn.)
Emery Industries, Inc. (Ohio)
Emulsol Corp., The (Ill.)
Hall, C. P. Co., The (Ohio)
Halowax Products Div. (N.Y.)
Union Carhide and Carhon Corp.
Harsyd Chemicals Inc. (Mich.)
Hooker Electrochemical (N.Y.)
Irvington Varnish & Insulator Co. (New Jersey)
Kessler Chemicals Co., Inc. (Pa.)
Kraft Chemical Co. (Ill.)
Mallinckrodt Chemical Works (Mo.)
Naugatuk Chemical Div. (Conn.)
Neville Co., The (Pa.)
Pittshurgh Plate Glass Co. (Pa.)
Procter & Gamble Co., The (Ohio)
Resinous Products & Chemical Co. (Pa.)
Schwartz Chemical Co. (N.Y.)
Standard Alcohol Co. (N.Y.)
Standard Chemical Co. (Ohio)
Wilmington Chemical Corp. (N.Y.)
Wohurn Chemieal Co. (N.J.)

RESEARCH CHEMICALS (for laboratories, pilot plants)

Edwal Laboratories, Inc., The (Ill.)
Fine Organics, Inc. (N.Y.)
Mallinckrodt Chemical Works (Mo.)
Merck & Co., Inc. (N.J.)

SOLVENTS

Acetel
Niacet Chemicals Div. (N.Y.)

Acetic Acid
City Chemical Corp. (N.Y.)

Acetone
Burnet Co., The (N.Y.)
Carhide & Carhon Chemicals Corp. (New York)
Chemical Mfg. Co. (N.Y.)
City Chemical Corp. (N.Y.)
Commercial Solvents Corp. (N.Y.)
Merck & Co., Inc. (N.J.)
Phillips & Jacohs (Pa.)
Shell Chemical Division (Cal.)
Standard Alcohol Co. (N.Y.)
Standard Chemical Co. (Ohio)
Stoney-Muller, Inc. (N.J.)
U. S. Industrial Chemicals (N.Y.)

Acetonitrile
Niacet Chemicals Div. (N.Y.)

Alcohol
City Chemical Corp. (N.Y.)
Pennsylvania Alcohol & Chemical Corp. (New York)
Stoney-Mueller Inc. (N.J.)

Alphechlornephthelene
Hooker Electrochemical Co. (N.Y.)

Amyl ecetate
Pennsylvania Alcohol & Chemical (New York)
Phillips & Jacohs (Pa.)

Amyl, butyl, ethyl propionetes
Pennsylvania Alcohol & Chemical (New York)

Arometic petrol
Velsicol Corp. (Ill.)

Benzol
Barrett Division, The, Allied Chemical & Dye Corp. (New York)
Koppers Co., Inc., Tar & Chemical Div. (Pennsylvania)

(Cont. on pg. 98)

Need Plastic rods, tubing, sheets in SMALL QUANTITY LOTS?

• JULIUS BLUM & CO. has them!

• IMMEDIATE DELIVERY from warehouse stocks of small or large production quantities.

TULOX* TT • Transparent Plastic Tubing
Available in a complete line of standard wall and heavy wall thicknesses from 3/16" O.D. up to and including 2" O.D.

TULOX* TT • Hollow Rod
Available in standard Hexagonal, Round and Knurled in large range of sizes. Carried in stock in H-3 flow as this is most suitable for machining.

FUNCTIONAL SHAPES
Suitable for use with rigid and flexible wall-covering materials. Wallboard shapes and Table Edgings and Nosings are carried in stock for immediate delivery.

POLYSTYRENE RODS AND SHEETS
Polystyrene rod available for delivery from warehouse stocks in sizes from 1/4" O.D. up to and including 4" O.D.

Polystyrene sheets for immediate delivery from warehouse stocks in sheets 24" x 24"—1/16", 1/8", 3/16", 1/4" thick, and 20" x 20"—3/8", 1/2", 3/4", 1" thick.

TENITE II • Transparent Solid Round Rod
Carried in stock for immediate delivery in sizes from 3/16" O.D. up to and including 2" O.D.

SARAN† • Pipe, Tubing, Fittings (black)
We carry complete stocks of SARAN pipe in sizes from 1/2" to 4" O.D. and SARAN tubing from 1/8" to 3/4". Also complete stocks of fittings.

*REG. U. S. PAT. OFF.

†PRODUCT DOW CHEMICAL CO.

Special shapes and sizes of tubing in a wide range of colors can be made to order in production quantities. Write for complete stock lists and prices.

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WATKINS 9-7042

WHY TRANSFER MOLDING PRODUCES BETTER IRONS

Modern iron handle designs call for complex side cores and undercut sections and are therefore produced at minimum costs and with maximum production rates by Transfer molding.

Because the mold is closed when the already plastic compound enters, the fin is reduced to a minimum and the parting line becomes a line without dimension. In fact, alert designers peak the parting line, making a design feature of this molding effect and thus eliminating buffing and polishing.

Actually, several of the advantages of Transfer molding are called into play by production of iron handles: lower costs, faster and longer production runs, more beauty, easier complexity, uniform strength.

Your nearby licensed Transfer molder can help you take advantage of this process, or you can learn more by writing for the literature mentioned below.

SHAW

SHAW INSULATOR COMPANY

160 COIT STREET QUALITY MARK ON MOLDED PLASTICS IRVINGTON 11, N. J.

LITERATURE IS AVAILABLE AS FOLLOWS:

A list of nearby licensees who can offer you the advantages of the patented Transfer molding process.

Two bulletins on "Why Transfer Molding is Economical". Bulletins on "Why Transfer Molding Gives Fine Inserts", "Why Transfer Molding Improves Appearance", "Why Transfer Molding Permits Better Holes", "Why Transfer Molding Permits Variable Walls", "Why Transfer Molding Gives Uniform Strength", and "Why Transfer Molding Gives Longer Runs".

Unbiased counsel in plastics applications is available from Shaw and Plax Corporation, Hartford 5, Conn. Between them, these companies use nearly all plastic processes. For names of nearby licensed Transfer molders and for literature listed above . . . write Shaw.

LEADING SOURCE OF PLASTICS IN SHEET, ROD, TUBE & FIBER FORMS

PLAX SUPPLIES these materials ↓ / in these forms →	Film & Slab	Rod	Tubing	Fiber
	Depending on the material, film ond slab come from .001" to 2.0" thick . . . rod from ⅛" to 6" diometer . . . tubing, ta arder . . . fiber from .005" to .090" diometer.			
Cellulose Acetate *In all colors, clear ta pearlescent*	✓	✓	✓	✓
Cellulose Acetate Butyrate *In all calars, clear ta pearlescent*	✓	✓	✓	✓
Ethyl Cellulose *In all calars, clear to pearlescent*	✓			✓
Methacrylate *In all colors, clear to pearlescent*		✓	✓	✓
Polyethylene	✓	✓	✓	✓
Polystyrene *In all colors, clear to pearlescent*	✓	✓	✓	✓

Also Vinyls, Cerex, Styraloy, and Plexene in various forms. Extrusion blown containers and shapes available in many of these materials.

Exclusive Plax developments have included the tough and flexible Polyflex* Sheet and Polyflex Fiber forms of polystyrene. Continuous research work, and a ready understanding of all application problems, make "PLAX FOR PLASTICS" more than a slogan. It should prompt you to ask today for scientific help. Write Plax Corporation, 133 Walnut St., Hartford 5, Conn.

Trade Mark Reg. U. S. Pat. Office

[CHEMICALS, SOLVENTS] Cont.

Benzyl alcohol
Hooker Electrochemical Co. (N.Y.)

Butane
Hall, C. P. Co., The (Ohio)

Butanol
Carbide and Carbon Chemicals Corp. (New York)
Commercial Solvents Corp. (N.Y.)

Butyl acetate
Carbide and Carbon Chemicals Corp. (New York)
Commercial Solvents Corp. (N.Y.)
Standard Chemical Co. (Ohio)
Stoney-Mueller, Inc. (N.J.)
U. S. Industrial Chemicals (N.Y.)

Butyl alcohol
Stoney-Mueller Inc. (N.J.)
U. S. Industrial Chemicals, Inc. (New York)

Butyl "carbitol"
Carbide and Carbon Chemicals Corp. (New York)

Butyl "cellosolve"
Carbide and Carbon Chemicals Corp. (New York)

Butyl phthalate
U. S. Industrial Chemicals, Inc. (New York)

Butyric acid
Carbide and Carbon Chemicals Corp. (New York)

Capryl alcohol
Hardesty Chemical Co., Inc. (N.Y.)
Resinous Products & Chemical Co. (Pennsylvania)

"Carbitol"
Carbide and Carbon Chemicals Corp. (New York)

Carbon bisulphida
American Cyanamid & Chemical Corp. (New York)
Baker, J. T. Chemical Co. (N.J.)
Kraft Chemical Co. (Ill.)
Phillips & Jacobs (Pa.)
Westvaco Chlorine Prod. Corp. (New York)

Carbon tetrachlorida
Diamond Alkali Company (Pa.)
Dow Chemical Company (Mich.)
Hall, C. P. Company, The (Ohio)
Pennsylvania Salt Mfg. Co., (Pa.)
Phillips & Jacobs (Pa.)
Westvaco Chlorine Products Corp. (New York)

"Callosolva"
Carbide and Carbon Chemicals Corp. (New York)

Chlorinatad solvant
Amecco Chemicals, Inc. (N.Y.)

Chlorpropana (liquid)
Hooker Electrochemical Co. (N.Y.)

Cyclohexana
Barrett Division, The Allied Chemical & Dye Corp. (New York)

Cyclohaxanol
Barrett Division, The, Allied Chemical & Dye Corp. (New York)
Hooker Electrochemical Co. (N.Y.)

Cyclohaxanona
Barrett Division, The, Allied Chemical & Dye Corp. (New York)

Danaturad alcohol
Pennsylvania Alcohol & Chemical Corp. (New York)
Stoney-Mueller, Inc. (N.J.)

Diacetone
Commercial Solvents Corp. (N.Y.)
Shell Chemical Division (Cal.)

Diacatona alcohol
Carbide and Carhon Chemicals Corp. (New York)

Diathylana glycol
Carhide and Carhon Chemicals Corp. (New York)

Di-Isobutylana
Standard Alcohol Co. (N.Y.)

Diisobutyl ketone
Carhide and Carhon Chemicals Corp. (New York)

Dioxana
Carhide and Carbon Chemicals Corp. (New York)

Enamel wira naphtha
Barrett Division, The (N.Y.)
Allied Chemical & Dye Corp.

Ethanol
Carhide and Carbon Chemicals Corp. (New York)

Ethyl acatate
Carbide and Carbon Chemicals Corp. (New York)
City Chemical Corp. (N.Y.)
Commercial Solvents Corp. (N.Y.)
Pennsylvania Alcohol & Chemical Corp. (New York)
Phillips & Jacobs (Pa.)
Stoney-Mueller, Inc. (N.Y.)
U. S. Industrial Chemicals, Inc. (New York)

[CHEMICALS, SOLVENTS] Cont.

Ethyl alcohol
U. S. Industrial Chemicals, Inc (New York)

Ethyl .ethar
Carbide and Carbon Chemicals Corp. (New York)

Ethyl lactata
American Cyanamid & Chemical Corp. (New York)
Stoney-Mueller, Inc. (N.J.)

Ethyl phthalate
U. S. Industrial Chemicals, Inc. (New York)

2-Ethylbutanol
Carbide and Carbon Chemicals Corp. (New York)

Ethylana dibromida
Westvaco Chlorine Products Corp. (New York)

Ethylene dichloride
Chemical Mfg. Co. (N.Y.)
City Chemical Corp. (N.Y.)
Hall, C. P. Co., The (Ohio)
Phillips & Jacobs (Pa.)
Westvaco Chlorine Products Corp. (New York)

Ethylene glycol
Carbide and Carbon Chemicals Corp. (New York)

2-Ethylhaxanol
Carbide and Carbon Chemicals Corp. (New York)

Furfural
Quaker Oats Co., The (Ill.)

Furfural alcohol
Quaker Oats Co., The (Ill.)

Fusel oil
Pennsylvania Alcohol & Chemical (New York)

Glacial acetic acid
Niacet Chemicals Division (N.Y.)

Glycerol
Merck & Co., Inc. (N.J.)

Haptane
Hall, C. P. Co., The (Ohio)

Heptanol-2
Carbide and Carbon Chemicals Corp. (New York)

Hexane
Hall, C. P. Co., The (Ohio)

Isobutylana
Standard Alcohol Co. (N.Y.)

Isophorone
Carbide and Carbon Chemicals Corp. (New York)

Isopropanol
Carbide and Carhon Chemicals Corp. (New York)

Isoprophyl acatata
Carbide and Carbon Chemicals Corp. (New York)
Standard Chemical Co. (Ohio)

Isopropyl alcohol
Phillips & Jacobs (Pa.)
Shell Chemical Division (Calif.)
Stoney-Mueller, Inc. (N.J.)
Standard Alcohol Co. (N.Y.)

Isopropyl chlorida
Hooker Electrochemical Co. (N.Y.)

Isopropyl ether
Carbide and Carbon Chemicals Corp. (New York)

Masityl oxide
Carbide and Carbon Chemicals Corp. (New York)

Methanol
Carbide and Carbon Chemicals Corp. (New York)
Colonial Chemical Company (N.J.)
Commercial Solvents Corp. (N.Y.)
du Pont, E. I. de Nemours & Co., Inc. Electrochemicals Dept. (Del.)
Merck & Co., Inc. (N.J.)
Stoney-Mueller, Inc. (N.J.)

Methyl acetate
Niacet Chemicals Div. (N.Y.)
Stoney-Mueller, Inc. (N.J.)

Methyl acatona
Carbide and Carhon Chemicals Corp. (New York)
Phillips & Jacobs (Pa.)

Methyl alcohol
Chemical Mfg. Co. (N.Y.)

Methyl "callosolve"
Carhide and Carbon Chemicals Corp. (New York)

Methyl ethyl ketona
City Chemical Corp. (N.Y.)
Shell Chemical Division (Calif.)
Standard Alcohol Co. (N.Y.)
Standard Chemical Co. (Ohio)

Methyl haxyl ketona
Hardesty Chemical Co., Inc. (N.Y.)
Resinous Products & Chemical Co., The (Pennsylvania)

Methyl isobutyl carbinol
Shell Chemical Division (Calif.)

Mathyl isobutyl ketona
Shell Chemical Division (Calif.)

[CHEMICALS, SOLVENTS] Cont.

Methylena chloride
Chemical Manufacturing (N.Y.)

Monochlorbenzene
Hooker Electrochemical Co. (N.Y.)

Monochlortoluene
Hooker Electrochemical Co. (N.Y.)

Nitro paraffins
Commercial Solvents Corp. (N.Y.)

Normal butyl acetate
Pennsylvania Alcohol & Chemical Corp. (New York)

Normal butyl alcohol
Pennsylvania Alcohol & Chemical Corp. (New York)

Orthodichlorbenzene
Hooker Electrochemical Co. (N.Y.)

Pant-acatata
Sharples Chemicals, Inc. (Pa.)

Pantasol
Sharples Chemicals, Inc. (Pa.)

Parchlorethylana
Westvaco Chlorine Products Corp. (New York)
Carbide and Carbon Chemicals Corp. (New York)

Polyethylene glycol
Hall, C. P. Company, The (Ohio)

Tetrahydrofurfuryl
Quaker Oats Co., The (Ill.)

Tetrahydrofurfuryl alcohol
Quaker Oats Company (Ill.)

Toluol
Barrett Division, The, Allied Chemical & Dye Corp. (New York)
Koppers Co., Inc. Tar & Chemical Div. (Pennsylvania)
Neville Company, The (Pa.)

Trichlorbenzene
Hooker Electrochemical Co. (N.Y.)

Trichlorethylene
Chemical Manufacturing Co. (N.Y.)

Triglycol dichloride
Carbide and Carbon Chemicals Corp. (New York)

Triglycol dihexoate
Carbide and Carbon Chemical Company (New York)

Xylenol
Barrett Division, The, Allied Chemical & Dye Corporation (New York)
Koppers Co., Inc., Tar & Chemical Div. (Pennsylvania)
Merck & Co., Inc. (N.J.)

Xylol
Barrett Division, The, Allied Chemical & Dye Corp. (New York)
Neville Company, The (Pa.)

Miscellaneous
American Resinous Chemicals Corp. (Massachusetts)
Carbide & Carbon Chemicals Corp. (New York)
Connecticut Hard Rubber Company, The (Connecticut)
Crescent Engineering & Research Co. (California)
Hall, C. P. Company, The (Ohio)
Herman, J. B. (Mass.)
Hooker Electrochemical (N.Y.)
Kraft Chemical Co. (Ill.)
Neville Co., The (Pa.)
Ohio-Apex, Inc. (W.Va.)
Penetone Company, The (N.J.)
Pittsburgh Plate Glass Co. (Pa.)
Schwartz Chemical Co. (N.Y.)

COATERS

FABRIC

Adhesive Products Corp. (N.Y.)
Athol Manufacturing Co. (Mass.)
Atlantic Mercantile Company (N.Y.)
Atlas Moulded Products Corp. (N.Y.)
Austin, O. Co., The (N.Y.)
Bancroft, Joseph & Sons Co. (Del.)
Barber-Webb Company, The (Calif.)
Barringham Rubber Co., Ltd., (Ont., Can.)
Bortman Plastics Co. (Mass.)
Burton-Rodgers, Inc. (Ohio)
Canadian General Rubber Co., Ltd. (Ontario, Canada)
Capac Manufacturing Co. (Mich.)
Carpenter, L. E. & Co. (N.J.)
Cincinnati Industries, Inc. (Ohio)
Cleaveland Lab. & Mfg. Company, Inc. (New Jersey)
Clover Mfg. Co. (Conn.)
Coated Textile Mills, Inc. (R.I.)
Cofax Corporation, The (N.Y.)
Colasta Company, Inc. (N.Y.)
Columbus Coated Fabrics Corp. (O.)
Cotan Corporation (N.J.)
Conn. Hard Rubber Co., The (Conn.)
Chrysler Corp. (Mich.)
Dawson Company (Ohio)
Detroit Gasket & Mfg. Co. (Mich.)
Electro-Technical Products, Inc. (New Jersey)
Endurette Corporation of America (N.J.)
Essential Fabrics Corp. (N.Y.)

[COATERS, FABRIC] Cont.

Fabricon Products, Inc. (Mich.)
Federal Leather Co., The (N.J.)
Flexfirm Products (Calif.)
General Laminating, Inc. (N.J.)
General Plastics Mfg. Co. (Wash.)
Goodrich, B. F. Company, The (Ohio)
Greggory, Inc. (Ill.)
Hartford Textile Company (N.Y.)
Heath Company (Mich.)
Heribert, Herbert J. (N.Y.)
Hopp Press, Inc., The (N.Y.)
Irvington Varnish & Insulator Co. (N.J.)
King Plastics Corp. (Colo.)
Landers Corporation, The (Ohio)
Libbey, W. S. Co., Inc. (N.Y.)
Lifetime Plastic, Inc. (Colo.)
Marco Chemicals, Inc. (N.J.)
Microloid Co. (Pa.)
Miner Rubber Co. Ltd. (Que., Can.)
Montrose Paper Mills (Ill.)
Mor-Gan Laminating & Foliating Co (New York)
National Research & Mfg. Co. (Calif.)
Nu-Lite Plastics (N.J.)
Pantasote Company, The (N.J.)
Permatex Fabrics Corp. (Conn.)
Plasticote Co. (N.J.)
Plastite Adhesive Cement Co. (Ill.)
Plastic Film Corporation (N.Y.)
Plastic Supply Company (Ont., Can.)
Portal Printing & Plastic Co. (Calif.)
Rand Rubber Company (N.Y.)
Respro, Inc. (R.I.)
Ryerson, Joseph T. & Son, Inc. (Ill.)
Schneider, Eugene S., Plastics (California)
Shellmar Products Co. (Ohio)
Sport Products, Inc. (Ohio)
Standard Coated Products (N.Y.)
Standard Insulation Co. (N.J.)
Stanley Mfg. Co., Ltd. (Ont., Can.)
Taylor Fibre Company (Pa.)
Textileather Corporation (Ohio)
Western Plastics, Ltd. (B.C., Can.)
Western Products, Inc. (Ohio)
Western Shade Cloth Co., The (Ill.)
Whiteford Plastics Co., Inc. (N.Y.)
Wills & Roberts Plastics Mfg. Corp (California)
Zapon Division (Conn.)
Atlas Powder Co.
Zapon-Keratol Div. (Conn.)
Atlas Powder Co.

GLASS FIBER

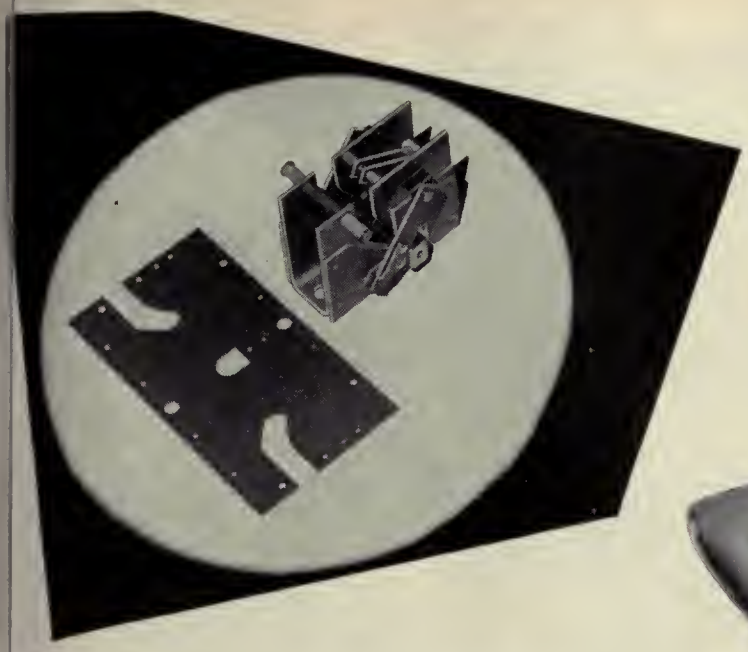
Compression Molding Company of St. Louis (Missouri)
Creative Printmakers, Inc. (N.Y.)
Heribert, Herbert J. (N.Y.)
Polyplastex (N.Y.)

METAL

Arvey Corporation (Ill.)
Austin, O. Co., The (N.Y.)
Barber-Webb Co., The (Calif.)
Cohan Epner Co., Inc. (N.Y.)
Chrysler Corp. (Mich.)
Denman Rust Proofing Co. (Calif.)
Fabricon Products, Inc. (Mich.)
General Plastics Mfg. Co. (Wash.)
Glover Coating Co. (Mass.)
Industrial Design Associates of Hollywood (California)
Lithgow, James Company (Calif.)
Merkert and Sons (N.Y.)
Mill-O-Plast (N.Y.)
National Research & Mfg. Co. (Calif.)
Parisian Novelty Company (Ill.)
Plastic Coating Co. (Calif.)
Plastic Film Corporation (N.Y.)
Plastics Service Company (Calif.)
Plastiques Laboratories, The (Ill.)
Soc-co Plastic Coating Co. (Calif.)
Uncas Manufacturing Co. (R.I.)
Wendt-Sonis Company (Mo.)
Western Products, Inc. (Ohio)
Whiteford Plastics Co., Inc. (N.Y.)
Wilcox-Gay Corp. (Mich.)

PAPER

American Products Mfg. Co. (La.)
Arvey Corporation (Ill.)
Austin, O. Co., The (N.Y.)
Bancroft, Joseph & Sons Co. (Del.)
Bortman Plastics Co. (Mass.)
Burton Rodgers, Inc. (Ohio)
Canadian General Rubber Co., Ltd. (Ontario, Canada)
Capac Manufacturing Co. (Mich.)
Carpenter, L. E. & Co. (N.J.)
Cellulose Products Co. (Calif.)
Cincinnati Industries, Inc. (Ohio)
Cleaveland Lab. & Mfg. Company, Inc. (New Jersey)
Clover Mfg. Co. (Conn.)
Coated Textile Mills., Inc. (R.I.)
Colasta Company, Inc. (N.Y.)
Columbus Coated Fabrics Corp. (O
Cotan Corporation (N.J.)
Dawson Company (Ohio)
Detroit Gasket & Mfg. Co. (Mich.
Electro-Technical Prod., Inc. (N.J.
Emeloid Co., Inc., The (N.J.)
Fabricon Products, Inc. (Mich.)



Shapely

Post-Formed Phenolite chassis for high voltage circuit breaker. All holes and cut-outs are punched in the flat blank (*foreground*) before post-forming in channel shape. Use of Phenolite chassis in place of metal eliminates insulation of each separate part of assembly.

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shapes profitable production and new products

There are opportunities for you in Post-Formed Phenolite—the laminated plastic that simplifies production and offers countless new applications for profitable-selling products!

Economical to produce, Post-Formed Phenolite parts are made in a matter of minutes. Practically any shape or form may be obtained simply by heating the sheet material a few seconds, then forming in low-cost wooden molds with standard press equipment. No sanding or "flash" removal is necessary. Fabrication may be done before or after forming.

Phenolite is extremely light in weight (about ½ that of aluminum); yet it has remarkable mechanical and impact strength. It possesses good machinability . . . is an excellent electrical insulator . . . resists heat and moisture . . . is resistant to abrasion . . . and is not affected by solvents and oils.

Find out some of the many ways in which this versatile material can be used. Write for full information and the assistance of one of our trained engineers.

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Flexfirm Products (Calif.)
General Laminating, Inc. (N.J.)
General Plastics Mfg. Co. (Wash.)
Goodrich, B. F. Company, The (Ohio)
Greggory, Inc. (Ill.)
Hawley Products Company (Ill.)
Heath Company (Mich.)
Hopp Press, Inc., The (N.Y.)
Hotchner, C. R. & Co. (N.Y.)
Industrial Design Associates of Hollywood (California)
Irvington Varnish & Insulator Co. (N.J.)
King Plastics Corp. (Colo.)
Libbey, W. S. Co., Inc. (N.Y.)
Lifetime Plastic, Inc. (Colo.)
Marco Chemicals, Inc. (N.J.)
Marvellum Company, The (Mass.)
Microloid Co. (Pa.)
Montrose Paper Mills (Ill.)
Mor-Gan Laminating & Foliating Co. (New York)
Pantasote Company, The (N.J.)
Parisian Novelty Company (Ill.)
Permatex Fabrics Corporation, The (Conn.)
Plastic Film Corporation (N.Y.)
Plastic Papers Co. (Ill.)
Plastic Supply Company (Ont., Can.)
Plasticote Co. (N.J.)
Plastiques Laboratories, The (Ill.)
Presco Plastics (Wis.)
Respro, Inc. (R.I.)
Riegel Paper Corp. (N.Y.)
Schneider, Eugene S., Pastics (California)
Scientific Engr. & Plastic Research Co. (New York)
Shellmar Products Co. (Ohio)
Standard Coated Products (N.Y.)
Standard Insulation Co. (N.J.)
Stanley Mfg. Co., Ltd. (Ont., Can.)
Taylor Fibre Company (Pa.)
Texloid Products Co. (Mass.)
Western Products, Inc. (Ohio)
Western Sbade Cloth Co., The (Ill.)
Wilcox-Gay Corp. (Mich.)
Zapon Division (Conn.) Atlas Powder Co.
Zapon-Keratol Div. (Conn.) Atlas Powder Co.

WIRE

Austin, O. Co., The (N.Y.)
Barber-Webb Co., The (Calif.)
Canadian General Electric Company (Ontario, Canada)
Denman Rust Proofing Co. (Calif.)
Industrial Design Associates of Hollywood (California)
National Research & Mfg. Co. (Calif.)
Plastic Coating Co. (Calif.)
Phillips Electrical Works Limited (Ont., Can.)
Plastics Service Company (Calif.)
Tensolite Corporation (N.Y.)
Wendt-Sonis Company (Mo.)
Whiteford Plastics Co., Inc. (N.Y.)

YARNS, CORDS

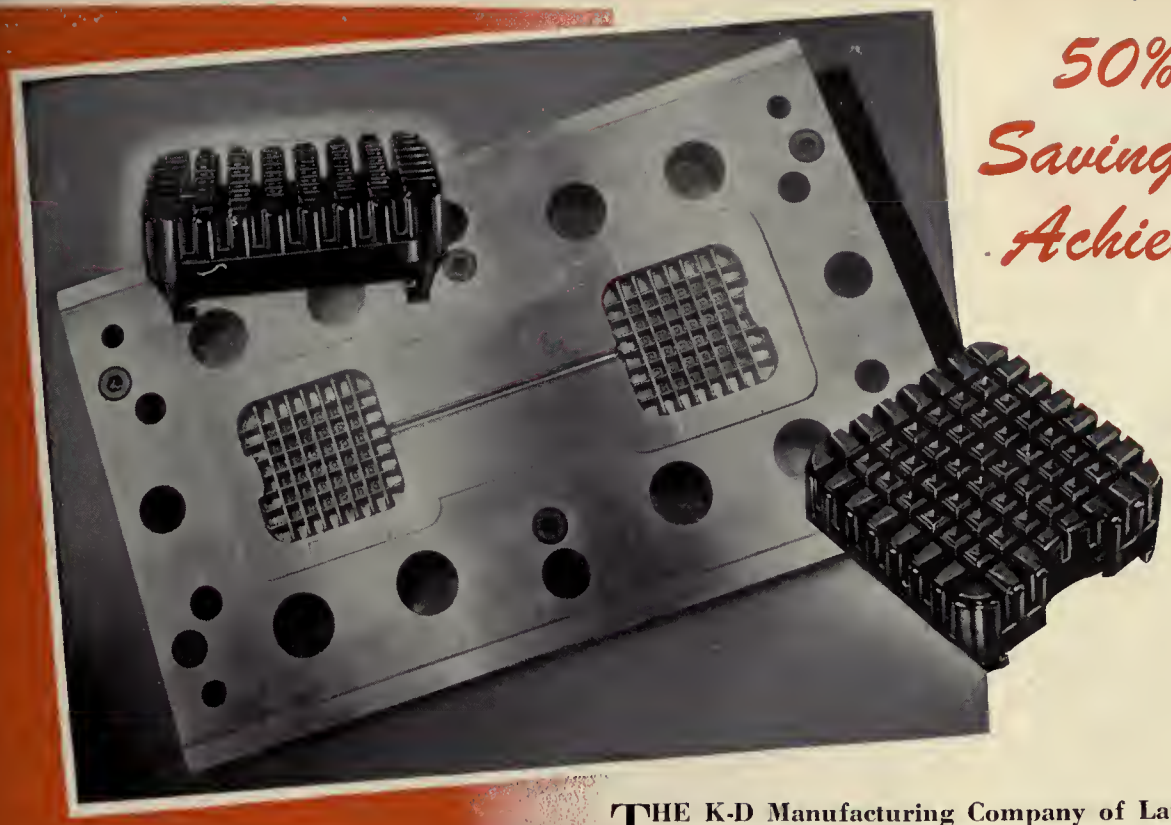
Tensolite Corporation (N.Y.)

EXPORTERS

Acap Company (N.Y.)
Barnett, Inc., Plastics (Ga.)
Crest Fabrics (N.Y.)
Eagle Export, Inc. (N.Y.)
Federal Equipment Co. (Ont., Can.)
Harving Paper Company (N.Y.)
International Exchange Corp. (Calif.)
Kestin, M. J. Company (N.Y.)
Larson, A. P. Company, The (N.Y.)
Liberty Mercantile Co., Inc. (N.Y.)
Omni Products Corporation (N.Y.)
Plastics Promotions (N.Y.)
Remco International Co. (N.Y.)
United Sales Service (Calif.)
Weeks, O. J. Co., Inc. (N.Y.)

FABRICATORS

A. A. Plastics Assoc. (N.Y.)
A. & L. Manufacturing Company (N.Y.)
Abbott Engineering & Insulating Co. (New Jersey)
Aceteloid Novelty Co. (N.Y.)
Ace Plastic Novelty Co. (N.Y.)
Aeme Plastic Co. (Calif.)
Acraglas Company (Calif.)
Acrylite Products, Inc. (N.Y.)
Airplastics Co. (Calif.)
Airply Forming Co. (Calif.)
Algerley Laboratories (Pa.)
All Plastic Mfg. Co. (Calif.)
Allanson Armature Mfg. Co. Ltd., The (Ontario, Canada)
Almae Plastics, Inc. (N.Y.)
American Denture Corp. (Ore.)
Amity Plastics Co., Inc. (N.Y.)
Angelus Plastic Industries (Calif.)
Anthony & Anthony (N.Y.)
Angus-Campbell, Inc. (Calif.)
Anzae Plastics Co. (Calif.)
Arclay Plastics Products (Calif.)
Arco Metalcraft, Inc. (N.Y.)
Arco Plastic Prod. Co. (N.Y.)
Arnold Plastic Co. (Ohio)
Art Industries (Ill.)
Art Pearl Works (N.J.)
Art Plastics Co. (Calif.)
Art Plastic Co. (N.Y.)
Art Plastics Mfg. Co. (Calif.)
Art Textile Decorating Co. (N.Y.)
Artcraft Plastics Corp. (N.Y.)
Artistic Plastics (N.Y.)
Associated Plastics (N.Y.)
Associated Plastics, Ltd. (Calif.)
Atlas Plastic Co. (Calif.)
Auto City Plastic Co. (Mich.)
Baff Mfg. Co., The (N.J.)
Bakoring, Inc. (Texas)
Ballard Plastics Corp. (Wash.)
Bangor Plastics, Inc. (Mich.)
Barron, J. E. & Associates (Ohio)
Bastian Bros. Co. (N.Y.)
Baxman, Charles G. W. (Mich.)
Beatty, Brook Plastics (Mo.)
Beaman Molded Products Co. (Ore.)
Belmont Plastics Co. (Calif.)
Bend-A-Lite Plastics Division (Ill.)
Bentek Company (N.Y.)
Bodde, B. M. (Calif.)
Bookout & Hutchins (Calif.)
Borkland Laboratories (Ind.)
Boyd, A. B. Co. (Calif.)
Brandenburg, Melford F. (N.Y.)
Brigham, R. B. Co. (Ohio)
Brilhart, Arnold Ltd. (N.Y.)
Brogan, Bvard F. (Pa.)
Bronson, F. E. Company, The (N.J.)
Bronzart Metals Co. (N.Y.)
Brooklyn Plastic Co. (N.Y.)
Bryce Plastic Industries (Calif.)
Buchsbaum, S. & Co. (Ill.)
Buckley, C. E. Co. (Mass.)
Burndy Engineering Co., Inc. (N.Y.)
Burton-Rodgers, Inc. (Ohio)
Cadillac Plastic Company (Mich.)
California Craftsmen (Calif.)
California Giftware (Calif.)
California Plastic Novelties (Calif.)
California Plastics Products Corp. (California)
Calplasti Corporation (Calif.)
Cambridge Paper Box Co. (Mass.)
Camfield Mfg. Co. (Mich.)
Campbell, J. Hugh Co. (Texas)
Carlite Company (Calif.)
Carroll, J. B. Co. (Ill.)
Cass Plasticrafters (Mich.)
Cellulose Products Company (Calif.)
Celoid Mfg. Co. (N.Y.)
Celomat Corporation (N.Y.)
Central Aircraft & Engraving Co. (California)
Central Plastics, Inc. (N.Y.)
Champion Display Material Co. (Wash).
Chicago Fabricated Products (Ill.)
Chicopee Manufacturing Corp. (New York)
Cinch Manufacturing Corp. (Ill.)
Clark, Geo. V. Co., Inc. (N.Y.)
Clark, Victor Marion Co. (N.Y.)
Clarolyte Co. (N.Y.)
Classic Studio (N.Y.)
Clover Box & Manufacturing Co., Inc. (N.Y.)
Cluthe, Geo. Mfg. Co. Limited (Ontario, Canada)
Coast Metal Plastics Manufacturing Co. (California)
Cobh & Zimmer (Mich.)
Cofax Corporation, The (N.Y.)
Colt's Patent Fire Arms Mfg. Co. (Connecticut)
Colonial Kolonite Co. (Ill.)
Columbia Plastics, Inc. (Calif.)
Columbia Plastics Mfg. Corp. (N.Y.)
Colwabord Limited (Ont., Can.)
Compression Molding Company of St. Louis
Comstock, J. (Calif.)
Cooper, Sam (Pa.)
Corbin Engineering & Sales Co. (California)
Coronet Novelty & Plastics Co., Inc. (New York)
Cournand, E. L. & Company (N.Y.)
Craft Service (N.Y.)
Crafts, Inc. (R.I.)
Crafts Industry (Ont., Can.)
Creative Plastics Corp. (N.Y.)
Croasdale & de Angelis (Pa.)
Crofut, Willard Co. (Calif.)
Crowe Name Plate & Mfg. Co. (Ill.)
Cruver Manufacturing Co. (Ill.)
Crystal Fixture Company (Ill.)
Crystalline Plastics Co. (Calif.)
Crystal-Tex Company (Calif.)
Cunningham Mfg. Co. Inc. (Ind.)
Curran & Barry Company (N.Y.)
Custom Manufacturing Co. (Calif.)
Custom Plastics Co. (Calif.)
Customcraft Plastic Co. (N.Y.)
Czecho Peasant Art Co. (N.Y.)
D L & M Plastic Industries (Ontario, Canada)
Darco Plastics Co. (Mass.)
Dawson Company (Ohio)
Davis, Joseph Plastics Co. (N.J.)
Decora Plastic Studios (Mich.)
Defense Products Co. (Calif.)
Del Riccio Plastics Corp. (Calif.)
Detroit Gasket & Mfg. Co. (Mich.)
Dilley Manufacturing Company, The (Ohio)
Display House, The (Penn.)
Dorian Studios (Calif.)
Du Art Plastics Co. (Pa.)
Du Bois Plastic Products (N.Y.)
Dugan & Krukemeier Mfg. Co. (Indiana)
Dulev Plastics Ltd. (Ont., Can.)
Duplate Canada Ltd. (Ont., Can.)
Dura Plastics, Inc. (N.Y.)
Duranol Products, Inc. (N.Y.)
Eastern Plastics, Inc. (Pa.)
Edwards, T. J. Inc. (Mass.)
Eclipse Moulded Products Co. (Wis.)
Electrical Insulation Co., Inc. (N.Y.)
Electric Storage Battery Co. (Pa.)
Electronic Mechanics, Inc. (N.J.)
Electronic Plastics Co. (N.J.)
Elkloid Company, The (R.I.)
Emeloid Co., Inc., The (N.J.)
Empire Plastics Company Limited (Quebec, Canada)
Enbee Transparent Specialty Co. (New York)
Enka Plastic Company (Calif.)
Erisman, A. C. (Pa.)
Evans Products Co. (Calif.)
Everbest Plastic Corporation (N.Y.)
Expert Celluloid Co., Inc. (N.Y.)
Fabricated Parts Co. (N.J.)
Fabri-Form Co., The (Ohio)
Farrington Mfg. Co. (Mass.)
Fawn Creations & Company (Md.)
Feature Products Corporation (Que., Can.)
Felsenthal, G. & Sons (Ill.)
Fine Arts Of California (Calif.)
Fishel-Vierling Company (Ohio)
Fisher, Adam (Penn.)
Fixmobil Co. (N.Y.)
Folsom Engraving Company (Mass.)
Forest Industries Research Co. (Washington)
Fowler, E. H. Co. (Calif.)
Franklin Fibre-Lamitex Corp. (Del.)
Franklin Industrial Engineering (Pennsylvania)
Galbas, Ferd F. (N.Y.)
Galvanic Art Studios (N.Y.)
Gem Plastics Co. (Calif.)
Gemloid Corporation (N.Y.)
Genii Corporation, The (Ohio)
Gibbs Manufacturing (Calif.)
Gibralter Supply & Service Co. (Pa.)
General Plastic Products (Mich.)
General Plastic & Rubber Co. (Ky.)
General Plastics Co. (Calif.)
Glade Mfg. Co. (Ill.)
Glass, Harry H. & Bro. (N.Y.)
Gordon, J. M. (N.Y.)
Goro Manufacturing Co., Inc. (N.Y.)
Gottlieb, M. M. Associates, Inc. (Pennsylvania)
Granby Mfg. Co. (Que., Can.)
Great Lakes Plastics (Ill.)
Greggory, Inc. (Ill.)
Gregori of Hollywood (Calif.)
Greenhut Insulation Co. (N.Y.)
Grosfeld House, Inc. (N.Y.)
H. B. Plastic Fabricating (N.Y.)
HR Engineering Company (Ind.)
Hammermill Paper Co. (Pa.)
Harson Mfg. Co. (N.Y.)
Heath Company (Mich.)
Hecht Fixture Co. (Ill.)
Herman, J. B. Co. (Mass.)
Hermant, Percy Limited (Ont., Can.)
Herschel Engineering & Supply Co. (Pennsylvania)
Hexco Products, Inc. (Ill.)
Hobbs Glass Limited (Ont., Can.)
Hoffmann Mfg. Co., (N.Y.)
Holdenline Co. (Ohio)
Hollywood Charms (Calif.)
Hollywood Ligbting Fixture Co., Inc. (Calif.)
Home Plastic Co. (Ill.)
Hollywood Plastic Arts (Calif.)
Hopp Press, Inc., The (N.Y.)
House of Plastics, The (Calif.)
House of Plastics (Ohio)
Hub Stamping & Engraving Co. (Massachusetts)
Hughes-Autograf Brush Co., Inc. (New York)
Hunton Plastics Co. (N.J.)
Hydroproducts Corporation (N.Y.)
Imperial Plastic Co. (Calif.)
Industrial Arts, Inc. (Ill.)
Industrial Fabricators, Inc. (Ohio)
Industrial Plastics Corp. (N.J.)
Ingwersen Manufacturing Co., Inc. (Colo.)
Inland Manufacturing Div., General Motors Corp. (Ohio)
Insulating Fabricators of New England, Inc. (Mass.)
International Plastics (Calif.)
International Plastic Products (California)
Irvington Varnish & Insulator Co. (N.J.)
Irwin Engineering & Mfg. Co. (California)
J. M. Plastic Containers (Calif.)
Johnson Fare Box Co. (Ill.)
Johnston Industrial Plastics Ltd. (Ont., Can.)
Joseff-Hollywood (Calif.)
Jo-Vel Plastic Co. (N.J.)
Joyce, Walter M. Co. (Ohio)
Judson, W. Haddon Mfg. Co. (Pa.)
K. C. Plastics Co. (Mo.)
K & S Plastic Designs Co. (N.Y.)
K-Plastix (Calif.)
Kehoe Display Fixture Co. (Calif.)
Kenneth, Donald Co., The (Calif.)
Keolyn Plastics (Ill.)
Kerr, R. W. Co. (Nebr.)
Keystone Plastics Company (Pa.)
King, J. M. Manufacturing Co. (Pa.)
King Plastics Corp. (Colo.)
King Plastics Corp. (N.Y.)
Kingsbacher-Murphy Co. (Calif.)
Kingman, E. B. Co. (N.Y.)
Kippy Kit Co. (Ohio)
Kirby Company (Ohio)
Kirk Plastic Co. (Calif.)
Klise Manufacturing Company (Mich.)
Kozell Bros. Inc. (Pa.)
Krasny Plastic Products (N.Y.)
La Mode Plastic Co., Inc. (N.Y.)
Lami Cast Plastics (Mo.)
Lamicoid Fabricators, Inc. (Ill.)
Lamotex Corp. (N.Y.)
Landers, Bert A., Inc. (Calif.)
Landers Corporation, The (Ohio)
Lapin Products, Inc. (N.J.)
Lawrence and Hunter (Calif.)
Lee-Bert, Inc. (Mich.)
Lee, Oscar (Ill.)
Lee Plastics (Pa.)
Leed Insulator Co. (Calif.)
LeRoy Novelty Plastics Co. (Calif.)
Levien, Ned G. Co., Inc. (N.Y.)
Lichten, Maurice A. Company (N.J.)
Lindy, M. L. Company (N.J.)
Lone Star Plastics Company (Texas)
Long Island Engraving Co. (N.Y.)
Lucigem Plastic Corp. (N.Y.)
Lustra-Cite Industries (N.Y.)
Lumirol Company (N.Y.)
Lurite Corp. (N.J.)
Majestic Plastic & Specialty Co. (Fla.)
Majestic Plastic Company, Inc. (Fla.)
Majot Automatic Machine Co., Inc. (N.J.)
Manne-Knowlton Insulation Co. (New York)
Mansion House Furniture Co. (California)
Marcraft Plastics (Minn.)
Mark Novelty Corp (N.Y.)
Marks Custom Plastic Co. (Calif.)
Marshall, William L. Ltd. (N.Y.)
Mastercraft Plastics Co., Inc. (N.Y.)
Mattel Creations (Calif.)
Matzner, S. Co. (N.Y.)
Mayfair Plastics Div., George Ulanet Co. (N.J.)
McCoy, Jones & Co., Inc. (Ill.)
McDowell Plastic Company (Ill.)
McGough, R. A. (Pa.)
McInerney Plastics Co. (Mich.)
McQuay Aircraft Corp. (Calif.)
Metaltex, Inc. (N.Y.)
Merri-Plastic Co. (Calif.)
Metropolitan Plastic Products Co. (New York)
Micamold Radio Corp. (N.Y.)
Micarta Fabricators, Inc. (Ill.)
Miller Dial & Name Plate Co. (California)
Miracle Patent Co. (Calif.)
Miracle Plastic Mfg. Co. (N.Y.)
Miro Container Co., Inc. (N.Y.)
Mitchell, F. L. Co. (Calif.)
Mitchell Button Co. Limited, The (Ont., Can.)
Mitten's Display Letters (Calif.)
Miya Flower & Novelty Co. (N.Y.)
Modern Plastic Co. (Calif.)
Modern Plastics (Fla.)
Modern Solid-Art Co. (Md.)
Moglen Plastic Products (N.Y.)
Monogram Mfg. Co. (Calif.)
Morrell, George Corp. (Mich.)
Morrison's (Calif.)
Mt. Vernon-Woodberry Mills, Inc. (Maryland)
Multi-Plex Mfg. Co. (Calif.)
Musser, H. M. & Co., Inc. (Pa.)
Mycalex Corporation of America (N.J.)
National Bronze Studios (Calif.)
National Fabricated Products (Ill.)
National Fabricating Co. (N.Y.)
National Fibre Co. (Ont., Can.)
National Plastic Company (Calif.)
National Plastic Products Co. (Mich.)
National Transparent Plastics Co. (Mass.)
National Vulcanized Fibre Co. (Del.)
Neo Designs Co. (N.Y.)
New England Novelty Co. (Mass.)
New Plastic Corp. (Calif.)
Newport, J. Herbert Jr. (Pa.)
Nichols Products Co. (N.J.)
Nonpareil Mfg. Co. (N.Y.)



50% Saving Achieved

Complete METAL-PLASTICS Facilities

•

ENGINEERING

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SCREW MACHINE PRODUCTS

METAL STAMPINGS & ASSEMBLIES

THE K-D Manufacturing Company of Lancaster, Pennsylvania formerly used a metal anvil on their popular fruit dicer widely used in hotels, restaurants and institutions. Looking for means of improving their product and reducing costs suggested the possibility of a plastic anvil. The rough metal anvil required milling of slots, machining the undercut, cleaning and polishing, plus the fact that porosity was not a satisfactory factor.

They brought their problem to us here at LANCE and together we went to work. The result is the two-cavity mold pictured above, with two views of the plastic anvil now part of the K-D fruit dicer.

This cam-operated mold allows the undercut to be molded in the initial operation. Machining, cleaning and polishing are eliminated and porosity is absent. The result is a 50% saving for the K-D folks . . . another example of how plastics can be applied to do things better—and more economically.

We'll welcome the opportunity to discuss any plastic or metal-plastic job with you, and you can be assured we'll be the first to tell you if plastics don't appear to be indicated as a solution to your problem. Call on us!

LANCE Manufacturing Company

FIFTH and COURTLAND STREETS • PHILADELPHIA 40, PENNA.

Novel-Craft Mfg. Co. (N.Y.)
Novelart Mfg. Co. (Calif.)
Nussbaun, F. J. & Co. (N.Y.)
Nutone, Inc. (Calif.)
Nu-World Products Co. (Calif.)
Obrig Laboratories, Inc. (N.Y.)
Oppenheimer, Walter L. & Son (Pa.)
Orna Plastics Co. (Calif.)
Ornamental Plastics Mfg. Co. (N.Y.)
Ortho Plastic Novelties (N.Y.)
Pacific Mills (N.Y.)
Pacific Plastic Prod. Co. (Calif.)
Para Mfg. Co., Inc. (N.J.)
Paramount Rubber Co. (Mich.)
Paragon Plastics Co. (Mich.)
Paragon Plastic Corporation (N.Y.)
Parkeat Plastics (N.Y.)
Parisian Novelty Company (Ill.)
Peerless Moulded, Inc. (N.Y.)
Peerless Products (Ill.)
Penn Fibre & Specialty Co. (Pa.)
Penn-Plastics Corporation (Pa.)
Pennsylvania Plastics Corp. (Pa.)
Penzel, Mueller & Co., Inc. (N.Y.)
Perfection Plastic Products (N.J.)
Perlman, A. Plastics, Inc. (N.Y.)
Photo Plastic Co. (Calif.)
Photoplating Company (Minn.)
Pikes Peak Plastics (Colo.)
Pioneer Plastics Co. (N.Y.)
Plascraft Co. (Calif.)
Plasteel (Calif.)
Plastelite Engineering Co. (Texas)
Plastic Accessories, Inc. (N.Y.)
Plastic Center Company (Calif.)
Plastic Center Company, Inc. (Calif.)
Plastic Creations of Hollywood (California)
Plastic Fabricators Company (Calif.)
Plastic Film Corporation (N.Y.)
Plastic Engineering Co. (R.I.)
Plastic Fabricators, Inc. (Mass.)
Plastic Finishing Corp. (Ill.)
Plastic & Metal Products Co. (Pa.)
Plastic Mold Engring. Co. (Mich.)
Plastic Novelties Mfg. Co. (Calif.)
Plastic Novelties, Inc. (N.Y.)
Plastic Playthings, Inc. (N.Y.)
Plastic Products Co. (Ohio)
Plastic Projects (N.Y.)
Plastic Star Co. (Calif.)
Plastic Turning Co., Inc. (Mass.)
Plastic-Ware, Inc. (N.Y.)
Plastic Wood Crafts (Ohio)
Plastichrome (Calif.)
Plasticles Mfg. & Sales Co. (Mich.)
Plasticraft (Calif.)
Plasticraft Mfg. Co. (N.J.)
Plasticrest Products (Ill.)
Plastics Co. (Calif.)
Plastics, Inc. (Minn.)
Plastics Service Company (Calif.)
Plastifab, Incorporated (Ill.)
Plastiform Mfg. Co., Inc. (Calif.)
Plasti-Glo Manufacturing Company (Ill.)
Plasti-Mode Novelty Co. (N.Y.)
Plastik, Inc. (Mass.)
Plastolite Company, The (Pa.)
Plax Corporation (Conn.)
Ply-Tex Mfg. Corp. (N.Y.)
Popular Plastic Prod. Corp. (N.Y.)
Portal Printing & Plastic Co. (Calif.)
Practical Plastics, Inc. (Fla.)
Precision Fabricators, Inc. (N.Y.)
Precision Plastic Prod. Co., Inc. (Illinois)
Precision Specialties (Calif.)
Precision Plastics (Calif.)
Precision Plastics Co. (Pa.)
Precision Products Co. (Wis.)
Premier Engineering Supplies, Ltd. (Ontario, Canada)
Preyer, Ruth (N.Y.)
Printloid, Inc. (N.Y.)
Printon Corporation (N.Y.)
R. & C. Plastic Products (R.I.)
RPM Company, The (Colo.)
Ranger-Tennere, Inc. (N.Y.)
Regal Plastic Company (Mo.)
Resin Industries (Calif.)
Resin-Wood Products Co. (Calif.)
Richardson Company (Ill.)
Risch, H. Celluloid Products (N.Y.)
Ritter Company, Inc. (N.Y.)
Robinson Industrial-Crafts, Ltd. (Ont., Can.)
Rogers Corp. (Conn.)
Rosenberg Brothers (N.Y.)
Ross Plastic Co., Inc. (N.Y.)
Rothco Products (Pa.)
Rummel Fibre Co. (N.J.)
Russell Specialty Mfg. Co. (Ill.)
Sandra Laboratories (Calif.)
San Francisco Plastics Co. (Calif.)
Scheuer Mfg. Co. (N.Y.)
Schillo Manufacturing Co. (Ill.)
Schneider, Eugene S. (Calif.)
Schwab & Frank, Inc. (Mich.)
Schwanda, B. & Sons (N.Y.)
Schwarz Brothers (Calif.)
Scripto Mfg. Co. (Ga.)
Seeberger, Fred B. (Pa.)
Sewell Mfg. Co. (Mich.)
Shepherd, J. H. Son & Co. (Ohio)
Sherr Manufacturing Co. (Calif.)

[FABRICATORS] cont.

Shoreham Mfg. Co., Inc. (N.Y.)
Sillcocks-Miller Company, The (N.J.)
Silverloid Co. (R.I.)
Slater, N. G. Corp. (N.Y.)
Sloane, John R. (Mass.)
Smith, Donovan & Associates (Pa.)
Smoot-Holman Co. (Calif.)
Snedaker, Frank C. & Co., Inc. (Pa.)
Solar Plastic Products Co. (N.Y.)
Somerville Limited (Ont., Can.)
Southern Plastics Company (S.C.)
Spartan Industrial Corp. (N.Y.)
Speed-Cutting, Incorporated (Calif.)
Speed Machine Products Co. (N.J.)
Sperber Mfg. Co. (Mich.)
Stack Plastics Co. (Calif.)
Standard Coated Products (N.Y.)
Standard Rubber Co. (N.Y.)
Starlight Jewelry & Novelty Co. (N.Y.)
Stars & Stripes Plastics Mfg. Co. (New York)
Steiner Manufacturing Co. (N.Y.)
Sterling Plastic Prod. Co. (Ohio)
Sto-Cant Engineering Co. (Calif.)
Straus & Stingo, Inc. (N.Y.)
Stricker-Brunhuber Co. (N.Y.)
Supreme Plastics Co. (Ill.)
Superior Plastics Corp. (N.Y.)
Supreme Plastic Mfg. Company (N.Y.)
Sward, H. A. Co. (N.Y.)
Swedlow Plastics Co. (Calif.)
T & L Plastic Mfg. Co. (Calif.)
Tauber Plastics, Inc. (N.Y.)
Taylor Fibre Company (Pa.)
Tech-Craft Plastics, Inc. (Wash.)
Technical Plastics Co. (Ohio)
Technical Plastics Laboratories (Calif.)
Technicraft Supply Co. (Mass.)
Thor-Sal Plastic Products (Calif.)
Thornton, Geo. Q. Displays (N.Y.)
Tilton & Cook Co. (Mass.)
Tingstol Company (Ill.)
Titan Plastic Products Co. (Calif.)
Toye Photo-Plastics (Calif.)
Transparent Container Co. (N.Y.)
Transparent Specialties Corp. (Ohio)
Transplastics Fabricating Company (Mass.)
Tupper Lake Plastics Co. (N.Y.)
Turner Plastic Products Co. (Mo.)
Twentieth Century Plastic Mfg. Co. (California)
Ucinite Co., The (Mass.)
Udylite Corporation, The (Mich.)
Ultra Plastic Co. (Calif.)
Uncas Manufacturing Company (R.I.)
U. S. Industrial Plastics Co. (N.Y.)
U.S. Plastic Co. (Calif.)
U. S. Rubber Co., Footwear Div. (Indiana)
Universal Button Fastening & Button Co. of Canada, Ltd. (Ont., Can.)
Universal Products (Calif.)
Universal Products, Inc. (Ill.)
Utleys (N.Y.)
Valley Manufacturing Company (Conn.)
Van Arnam Manufacturing Co. (Ind.)
Vargish and Company (N.Y.)
Veri-Nu Products Co. (Calif.)
Vernon-Benshoff Co. (Pa.)
Victory Plastics Co. (Mass.)
Vierling's Plastic House (Ohio)
Vine-Ite Plastics Company (Colo.)
Vogue Manufacturing Co. (Calif.)
Voges Manufacturing Company (N.Y.)
Walker Engraving Co. (Calif.)
Walter, John & Sons, Ltd. (Ontario, Canada)
Warren, S. D. Co. (Mass.)
Welker Mfg. Co., Inc. (Conn.)
Wesco Products (Calif.)
West Coast Industries (Calif.)
West Coast Plastics Products Co. (California)
Western Plastics Ltd. (B.C., Can)
White Products Company (N.Y.)
White, Thos. J. Plastics Co. (Mo.)
Whitehead & Hoag Co. (N.J.)
Wills & Roberts Plastics Mfg. Corp. (Calif.)
Wilmington Fibre Specialty Co. (Delaware)
Wolverine Plastic Studio (Mich.)
Wright Rubber Products Div., Taylor Manufacturing Co. (Wis.)
Woodall Industries, Inc. (Mich.)
World Plastic Manufacturing Company (N.Y.)
Wynn Mfg. Co. (Pa.)
Ybarra, Al (Calif.)
Yeager, Joseph E. (Pa.)
York Plastic Industries (Ont., Can.)
Zinglass Prod. Co. of America (N.Y.)
Zippy Corporation (Wash.)

HEAT SEALING

Ackerman-Gould Co. (N. Y.)
Barber-Webb Company, The (Calif.)
Boyd, A. B. Co. (Calif.)
Buchsbaum, S. & Co. (Ill.)
Croasdale & deAngelis (Pa.)
Dawson Company (Ohio)

[HEAT SEALING] cont.

Die-Plast Co. Ltd. (Que., Can.)
Eastern Plastics, Inc. (Pa.)
Gemloid Corporation (N. Y.)
General Plastics Mfg. Co. (Wash.)
Gits Molding Corp. (Ill.)
Goodyear Tire & Rubber Co. (Ohio)
Greggory, Inc. (Ill.)
Hubbard Oven Co. (Ill.)
International Plastic Products (California)
Lifetime Plastic Inc. (Colo.)
Microloid Co. (Pa.)
Mitchell, F. L. Co. (Calif.)
Plastic Film Corporation (N. Y.)
Plastic Laminating Co. (Calif.)
Plasticraft Products Co. (N. Y.)
Plastics Service Company (Calif.)
Plastiques Laboratories, The (Ill.)
Plastomatic Corporation (Pa.)
Sbellmar Products Co. (Ohio)
Tech-Craft Plastics, Inc. (Wash.)
Western Plastics Ltd. (B. C., Can.)
Western Products, Inc. (Ohio)
Zapon Division (Conn.) Atlas Powder Co.

IMPREGNATORS

American Brakeblok Division American Brake Shoe Co. (Mich.)
Atlas Plastic Industries (Md.)
Bangor Plastics, Inc. (Micb.)
Bortman Plastics Co. (Mass.)
Cambridge Paper Box Co. (Mass.)
Capac Manufacturing Co. (Mich.)
Chemical Plastics, Inc. (Minn.)
Chrysler Corp. (Mich.)
Cincinnati Industries, Inc. (Ohio)
Darco Plastics Co. (Mass.)
Deutsch, Maurice (N.Y.)
Die-Plast Co., Ltd. (Que., Can.)
Eldorado Mfg. Co. (Calif.)
Fabricon Products, Inc. (Mich.)
Farley & Loetscher Mfg. Co. (Iowa)
Fibreweld Processes Limited (B.C., Can.)
Flexfirm Products (Calif.)
Furane Plastics and Chemicals Company (Calif.)
General Plastics Mfg. Co. (Wash.)
Genii Corporation, The (Ohio)
Greggory, Inc. (Ill.)
Gustin-Bacon Mfg. Co. (Mo.)
Harbor Plywood Corp. (Wash.)
Heath Company (Mich.)
Howard Manufacturing Corp. (Iowa)
Industrial Design Associates of Hollywood (Calif.)
K-Plastix (Calif.)
Keller Products (N.H.)
Kellogg Switchboard & Supply Co. (Ill.)
King Plastics Corp. (Colo.)
Lifetime Plastic, Inc. (Colo.)
Lithgow, James Company (Calif.)
Mill-O-Plast (N.Y.)
Pantasote Company, The (N.J.)
Plastite Adhesive Cement Co. (Ill.)
Plastic Supply Company (Ont., Can.)
Plastiques Laboratories, The (Ill.)
Polyplastex (N.Y.)
Radio Corp. of America (N.Y.)
Radolite Mfg. Co. (Miss.)
Riegel Paper Corp. (N.Y.)
Rogers Corporation (Conn.)
Schneider, Eugene S., Plastics (California)
Scientific Engr. & Plastic Research Co. (New York)
Shellmar Products Co. (Ohio)
Struthers Wells Corporation (Pa.)
Taylor Fibre Company (Pa.)
Texloid Products Co. (Mass.)
Western Plastics, Ltd. (B.C., Can.)
Western Products, Inc. (Ohio)
Wills & Roberts Plastics Mfg. Corp. (California)
Wilmington Fibre Specialty Co. (Delaware)

LAMINATING, IMPREGNATING, COATING MATERIALS

ASBESTOS

Asbestos Fibre Spinning Corp. (Pa.)
Asbestos Textile Co., Inc. (Ill.)
Carey, Philip Mfg., Co. (Ohio)
Gatke Corp. (Ill.)
Johns-Mansville Sales Corp. (N.Y.)
Pecora Paint Co. (Pa.)
Powhatan Mining Co. (Md.)
Raybestos-Manhattan, Inc. (Pa.)
Thermoid Rubber Div. (N.J.)
United States Rubber Co. (N.Y.)
Victor Mfg. & Gasket Co. (Ill.)
Vermont Asbestos Mines (N.Y.)
York Plastic Industries (Ont., Can.)

FABRICS

Callaway Mills, Inc. (N.Y.)
Chicopee Mfg. Corp. (N.J.)
Curran & Barry Co. (N.Y.)

[LAMINATING MATERIALS] cont.

Deering, Milliken & Co. (N.Y.)
Exeter Manufacturing Co. (N.Y.)
Lane, J. H. & Company, Inc. (N.Y.)
Mt. Vernon-Woodberry Mills., Inc. (Maryland)
Owens-Corning Fiberglas Corp. (O.)
Pacific Mills (N.Y.)
Plastic Supply Co. (Que., Can.)

PAPER

Hammermill Paper Co. (Pa.)
Hermanson, Wm. A. & Co. (Mass.)
Hummel-Ross Fibre Corp. (Va.)
Hurlbut Paper Company (Mass.)
Krafelt Corporation (Del.)
Montrose Paper Mills (Ill.)
Mosinee Paper Mills Co. (Ill.)
Munising Paper Co., The (Ill.)
Plastic Supply Co. (Que., Can.)
Riegel Paper Corp. (N.Y.)
Walker-Goulard-Plehn Co. (N.Y.)
Warren S. D. Co. (Mass.)

RESINS

American Cyanamid Company (N.Y.)
Bakelite Corporation (N.Y.)
Baker Oil Tools, Inc. (Calif.)
Catalin Corporation (N.Y.)
Chemical Plastics, Inc. (Minn.)
Chrysler Corp. (Mich.)
Dow Chemical Company (Mich.)
Dow Corning Corporation (Mich.)
Durez Plastics & Chemicals, Inc. (New York)
Durite Plastics, Inc. (Pa.)
Furane Plastics & Chemicals Company (California)
Interlake Chemical Corp. (Ohio)
Marblette Corporation (N.Y.)
Marco Chemicals, Inc. (N.J.)
Monsanto Chemical Co., Plastics Div. (Massachusetts)
Pennsylvania Coal Products Co. (Pennsylvania)
Pittsburgh Plate Glass Co. (Pa.)
Plaskon Div., Libbey-Owens-Ford Glass Co. (Ohio)
Poly Resins (Calif.)
Reichhold Chemicals, Inc. (Mich.)
Resinous Products & Chemical Company (Pennsylvania)
Shawinigan Products Corp. (N.Y.)
Sylvan Plastics, Inc. (N.Y.)
Synvar Corporation (Del.)
Union Bay State Company (Mass.)
Valentine Sugars (La.)
Varcum Chemical Corp. (N.Y.)

LAMINATORS

Aircraft Plastics (Calif.)
Airply Forming Co. (Calif.)
Allanson Armature Mfg. Co., Ltd., The (Ontario, Canada)
Allied Aviation Corporation (Md.)
American Brakeblok Division American Brake Shoe Co. (Mich.)
Andover Kent Aviation Corporatioo (N.J.)
Artcraft Plastics, Inc. (Minn.)
Atlas Plastic Industries (Md.)
Baker McMillan Co. (Ohio)
Ballard Plastics Corp. (Wash.)
Bangor Plastics, Inc. (Mich.)
Bastian Bros. Co. (N.Y.)
Beacon Box Co. (Calif.)
Berst-Foster-Dixfield Co. (N.Y.)
Buchsbaum, S. & Co. (Ill.)
C-W Plywood Company (Ill.)
Camfield Mfg. Co. (Mich.)
Canadian Westinghouse Co., Ltd. (Ontario, Canada)
Capac Manufacturing Co. (Mich.)
Carroll, J. B. Co. (Ill.)
Celastic Corp (N.J.)
Chemical Plastics, Inc. (Minn.)
Chrysler Corp. (Mich.)
Cockshutt Moulded Aircraft Limited (Ontario, Canada)
Commonwealth Products Co. (Pa.)
Compression Molding Co. of St. Louis (Missouri)
Consolidated Water Power & Paper (Wisconsin)
Continental Can Co. (Ohio)
Continental-Diamond Fibre Co. (Del.)
Crescent Panel Co. (Ky.)
Cruver Manufacturing Co. (Ill.)
Damascus Furniture Corp. (Va.)
Dawson Company (Ohio)
Daystrom Corporation (N.Y.)
Durashield Plastic Prod. (Calif.)
Electronic Plastics Co. (N.J.)
Emeloid Co. Inc., The (N.J.)
Fabricon Products, Inc. (Mich.)
Formica Insulation Co., The (Ohio)
Franklin Fibre-Lamitex Corp. (Del.)
General Electric Co, Plastics Div. (Mass.)
General Electric Corp. (Lynn, Mass.)
General Plastics Co. (Calif.)
General Textile Mills, Inc. (N.Y.)
Goodyear Aircraft Corp. (Ohio)
Harbor Plywood Corp. (Wash.)
Hartzell Industries (Ohio)
Haskelite Mfg. Co. (Mich.)
Hereshoff Mfg. Co. (R.I).
Hood Rubber Co. (Mass.)

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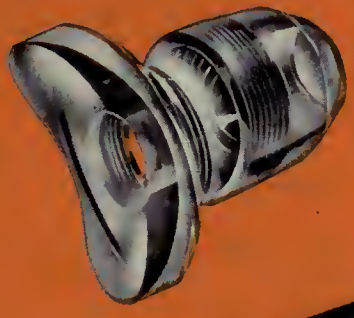
Slaco PRODUCTS

FABRICATED IN METAL OR PLASTIC TO YOUR SPECIFICATIONS

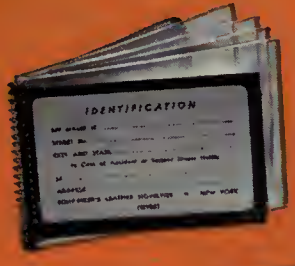
RADIO PARTS

PRECISION PARTS



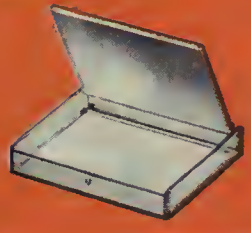
ADVERTISING SPECIALTIES

OFFICE SUPPLIES



COUNTER DISPLAY SIGNS

PLASTIC CONTAINERS



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MACHINING	LAMINATING, ETC.

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LUMARITH	PLASTACELE
CELLULOID	LUCITE
VINYLITE	PLEXIGLAS
BAKELITE	VULCANIZED FIBRE
PYRALIN	AND ALL OTHER PLASTICS

SEND US YOUR BLUEPRINTS AND SPECIFICATIONS

N. G. SLATER CORPORATION

Manufacturers of Plastic and Metal Products

3 WEST 29th STREET, NEW YORK 1, N. Y.

[LAMINATORS] Cont.

Hopp Press, Inc., The (N.Y.)
Industrial Plastics (N.Y.)
Inland Manufacturing Division (O.)
International Molded Plastics, Inc. (Ohio)
Kingshacher-Murphy Co. (Calif.)
Leister-Kauffman (Miss.)
Lifetime Plastic, Inc. (Colo.)
McQuay Aircraft (Calif.)
Marathon Chemical Co. (Wis.)
Marine Air Research (Conn.)
Masonite Corp. (Ill.)
Mattin, N. W. Bros. (Va.)
Mica Insulator Company (N.Y.)
Microloid Co. (Pa.)
Mine Safety Appliances Company (Pa.)
National Transparent Plastics Co. (Mass.)
Modern Plastics Corp. (Mich.)
Mor-Gan Laminating & Foliating Co. (New York)
National Plastic Products Co. (Md.)
National Research & Mfg. Co. (Calif.)
National Vulcanized Fibre Co. (Del.)
Olson Printing & Plastic Co. (Calif.)
Owens-Corning Fiberglas Corp. (O.)
Panelyte Div., St. Regis Paper Co. (New York)
Paramount Rubber Co. (Mich.)
Parisian Novelty Company (Ill.)
Parkwood Corporation (Mass.)
Passer Plastics Co. (Calif.)
Farley & Loetscher Mfg. Co. (Iowa)
Plastic Laminating Co. (Calif.)
Plastic Supply Company (Ont., Can.)
Plastics Service Company (Calif.)
Permochart Company, The (Pa.)
Plasteel (Calif.)
Plastic Industries (N.Y.)
Plasticles Mfg. & Sales Co. (Mich.)
Plastics Mfg. & Supply Co. (Calif.)
Pluswood, Inc. (Wis.)
Pioneer Plastic Co. (Calif.)
Pioneer Plastics Corp. (Md.)
Portal Printing & Plastic Co. (Calif.)
Protecto Photo Co. (N.Y.)
Pyraglass, Inc. (N.Y.)
Rand Rubber Company (N.Y.)
Ranger-Tennere, Inc. (N.Y.)
Richardson Co., The (Ill.)
Riegel Paper Corp. (N.Y.)
Rogers Corp. (Conn.)
San Francisco Plastics Co. (Calif.)
Slater, N. G., Corp. (N.Y.)
Southern Industries (N.C.)
Spaulding Fibre Co. (N.Y.)
Stanley Mfg. Co. Limited (Ont., Can.)
Stalite, Inc. (N.Y.)
Synthane Corp. (Pa.)
Taylor Fibre Co. (Pa).
Tensolite Corporation (N.Y.)
Texloid Products Co. (Mass.)
Tray-Ware, Inc. (Ohio)
United States Rubber Co. (Ind.)
Universal Molded Products (Pa.)
Universal Molded Products Co. (Va.)
Victory Plastics Co. (Mass.)
Vidal Research Corp. (N.J.)
Westinghouse Electric Corp. (Pa.)
White, Thos. J. Plastics Co. (Mo.)
Wills & Roberts Plastics Mfg. Corp. (Calif.)
Willson Magazine Camera Company (Pa.)
Willson Plastics (Pa.)
Wilmington Fibre Specialty Co. (Delaware)
Woodall Industries, Inc. (Mich.)
Wright Rubber Products Div. (Wis.)

MACHINERY, EQPT.

[*Indicates manufactures laboratory equipment; **indicates manufactures both laboratory and production equipment.]

MOLDING ACCESSORIES

Accessory parts for molds

Ace Tool & Mfg. Co. (N.J.)
Acme-Danneman Co., Inc. (N.Y.)
Ajax-Doret Metal Products Limited (Ontario, Canada)
Chicago Tool & Engineering Co. (Ill.)
Parker Stamp Works, Inc. (Conn.)
Woshyna Plastic Mold Co. (Mich.)

Agitators

Ace Tool & Mfg. Co. (N.J.)
Biggs Boiler Works Co., The (Ohio)
Devine, J. P. Mfg. Co. (Ill.)
Diecraft (Md.)
Edge Moor Iron Works (Del.)
First Machinery Corp. (N.Y.)
International Engineering, Inc. (O.)
Leominster Tool Co., Inc. (Mass.)
Loomis, Evarts G. Co. (N.J.)
Nooter, John Boiler Work Co. (Mo.)
Patterson Foundry & Machine Co., The (Ohio)
Porter, H. K. Co., Inc. (Pa.)
Struthers Wells Corp. (Pa.)
Read Machinery Co., Inc. (Pa.)

[MACH., MOLDING ACCESS.] Cont.

Air cylinders

Curtis Pneumatic Machinery (Mo.)

Air hammer (to empty mold)

Independent Pneumatic Tool Co. (Illinois)
Buckeye Tools Corp. (Ohio)

Air hoists

Curtis Pneumatic Machinery (Mo.)

Automatic time cycle control systems

ATC CO., Inc. (Pa.)

Bending

O'Neil-Irwin Mfg. Co. (Minn.)

Blanking cutters

Aircraft Tools, Inc. (Calif.)
Ajax-Doret Metal Products Limited (Ontario, Canada)
Albert, L. & Son (N.J.)
Diecraft (Md.)
Holm's Mfg. Company (Wis.)
Leominster Tool Co., Inc. (Mass.)
Standard Tool Co. (Mass.)

Blowers

Albert, L. & Son (N.J.)
American Blower Corp. (Mich.)
Breuer Electric Mfg. Co. (Ill.)
Buffalo Forge Company (N.Y.)
Champion Blower & Forge Co. (Pa.)
First Machinery Corp. (N.Y.)
Leiman Bros., Ins. (N.J.)

Brakes

O'Neil-Irwin Mfg. Co. (Minn.)

Cake mixers

Albert, L. & Son (N.J.)
First Machinery Corp. (New York)
Read Machinery Co., Inc. (Pa.)

Carving spindle (to remove flash and sprue)

Ekstrom Carlson & Co. (Ill.)
Ferriot Brothers, Inc. (Ohio)
Invincible Tool Co. (Pa.)
Leominster Tool Co., Inc. (Mass.)
Severance Tool Industries, Inc. (Michigan)

Centrifuges

Albert, L. & Son (N.J.)
Nooter, John, Boiler Work Co. (Mo.)

Compressed air equipment

Aircraft Tools, Inc. (Calif.)
Albert, L. & Son (N.J.)
Aro Equipment Corporation (Ohio)
Buckeye Tools Corp. (Ohio)
Curtis Pneumatic Machinery (Mo.)
Curtis Refrigerator Machine Div. (Missouri)
DeVilbiss Co., The (Ohio)
First Machinery Corp. (New York)
Ferriot Brothers, Inc. (Ohio)
Hy-Speed Press Co. Inc. (Ill.)
Mead Specialties Co. (Ill.)
Miller Motor Co. (Ill.)
Nash Engineering Co. (Connecticut)
U.S. Air Compressor Co. (Ohio)

Cooling, shrinking fixtures

Ace Tool & Mfg. Co. (N.J.)

Dicing Machinery

Taylor, Stiles & Co. (New Jersey)

Die-Making Machines

Oliver Instrument Co. (Michigan)

Drill Grinders

Oliver Instrument Co. (Michigan)

Electric industrial trucks

Automatic Transportation Co. (Ill.)

Elevating tables

Albert, L. & Son (N.J.)
Baldwin Southwark Div. (Pa.)
Baldwin Locomotive Works, The
Economy Engineering Co. (Ill.)
Elmes Engr. Wks. of Amer. Steel Foundaries (Illinois)
Farrel-Birmingham Co., Inc. (Conn.)
French Oil Well Machinery Co. (O.)
Hamilton Tool Co., The (O.)
Industrial Equipment Co., (N.J.)
Improved Paper Machinery Corp. (New Hampshire)
Loomis, Evarts G. Co. (N.J.)
Lyon-Raymond Corp. (N.Y.)

Extrusion System

Industrial Oven Engineering Co. (O.)

Filters, air, gas & liquid

Dollinger Corp. (N.Y.)
Holm's Mfg. Co. (Wisconsin)
Univertical Machine Co. (Michigan)

Generators for Pre-Heating

RCS Victor Co., Ltd. (Ont., Can.)

Heating

American Blower Corp. (Mich.)

Mixing bowls

Edge Moor Iron Works (Del.)
First Machinery Corp. (New York)
Nooter, John Boiler Work Co. (Mo.)
Read Machinery Co., Inc. (Pa.)

Mold Cleaning

Severance Tool Industries, Inc. (Michigan)
Stow Manufacturing Co. (New York)

Mold Lettering

Pannier Bros. Stamp Co. (Pa.)

[MACH., MOLDING ACCESS.] Cont.

Motorized hand trucks

Automatic Transportation Co. (Ill.)

Preform Loader

Standard Machinery Co. (Conn.)

Preheating ovens

Blodgett, G. S. Co., Inc. (Vt.)
Brosites Machine Co., Inc. (N.Y.)
Despatch Oven Co. (Minn.)
Electric Heater Co., The (Conn.)
Federal Telephone and Radio Corp. (New Jersey)
Industrial Oven Engineering Co., The (Ohio)
Infra-Red Engineers & Designers (Ohio)
Kirk & Blum Mfg. Co., The (Ohio)
Knapp, James H. Co. (Calif.)
Koch, George Sons, Inc. (Ind.)
Leominster Tool Co., Inc. (Mass.)
Rockwell, W. S. Company (Conn.)
Standard Tool Co. (Mass.)
Young Bros. Co. (Michigan)

Radio frequency heating

RCA Victor Co., Ltd. (Ont., Can.)

Rag clip cutter

Taylor, Stiles & Co. (New Jersey)

Scales

Detecto Scales Inc. (N.Y.)
Exact Weight Scale Co., The (Ohio)

Shears

O'Neil-Irwin Mfg. Co. (Minnesota)

Shim

Industrial Products Suppliers (N.Y.)

Steel plates

Acme-Danneman Co., Inc. (N.Y.)
Nooter, John Boiler Work Co. (Mo.)

Steel Housings for Molding Presses

Falstrom Co. (New Jersey)

Time delay relays

Ajax-Doret Metal Products Limited (Ontario, Canada)
American Gas Furnace Co. (N.J.)
Armstrong Bros. Engineering Co. Ltd. (Ontario, Canada)
Arrowsmith Tool & Dies Co. (Calif.)
Cramer, R. W. Co. Inc. (Conn.)
Electric Heater Co., The (Conn.)

PRESSES

Arbor

Acromark Company, The (N.J.)
Albert, L. & Son (N.J.)
Barber, F. F. Machinery Company (Ontario, Canada)
Bourke & Mabee (Ont., Can.)
Champion Blower & Forge Co. (Pa.)
Famco Machine Company (Wis.)
Farquhar, A. B. Company (Pa.)
Greenerd Arbor Press Co. (N.H.)
Hannifin Mfg. Co. (Ill.)
Hydraulic Machinery Inc. (Mich.)
Keckley, O. C. Co. (Ill.)
Munton Mfg. Co. (Ill.)
Stricker-Brunhuber Co. (New York)
V & O Press Co., Inc., The (N.Y.)
Walsh Press & Die Co. (Illinois)
Watson Stillman Co. (New Jersey)

Air

Mead Specialties Co. (Ill.)

Blanking

Albert, L. & Son (N.J.)
Barber, F. F. Machinery Company (Ontario, Canada.)
Bliss, E. W. Company (N.Y.)
Cleveland Punch & Shear Works Co. (Ohio)
Colonial Broach Co. (Mich.)
Denison Engineering Co. (Ohio)
Royersford Foundry & Machine Co., Inc. (Pennsylvania)
Walsh Press & Die Co. (Illinois)

Caking

Albert, L. & Son (N.J.)
Baldwin Southwark Division (Pa.)
Baldwin Locomotive Works, The
Birdsboro Steel Foundry & Machine Company (Pennsylvania)
Cavagnaro, John J. (N.J.)
Denison Engineering Co. (Ohio)
First Machinery Corp. (New York)
French Oil Well Machinery Co. (O.)
Industrial Equipment Co. (N.J.)
Universal Hydraulic Machinery Co. (New York)

Closure

Albert, L. & Son (N.J.)
Loomis, Evarts G. Co. (N.J.)
Standard Machinery Co. (Conn.)
Stokes, F. J. Machine Co. (Pa.)

Cold molding

Albert, L. & Son (N.J.)
Baldwin Southwark Division (Pa.)
Baldwin Locomotive Works, The
Dunning & Boschert Press Co. (New York)
Farquhar, A. B. Company (Pa.)
Farrel-Birmingham Co., Inc. (Conn.)
Francis, Chas. E. Co. (Ind.)
French Oil Well Machinery Co. (O.)
Grant Research Laboratory (Ill.)
Hydraulic Press Mfg. Co. (O.)

[MACHINERY, PRESSES] Cont.

Industrial Equipment Co. (N.J.)
Kux Machine Co. (Ill.)
Lake Erie Engineering Corp. (N.Y.)
Loomis, Evarts G. Co. (N.J.)
Standard Machinery Co. (Conn.)
Stereotex Machinery Co. (Conn.)
Stokes, F. J. Machine Co. (Pa.)
Watson, Stillman Co. (New Jersey)
Universal Hydraulic Machinery Co. (New York)

Compression

Adamson United Co. (Ill.)
Albert, L. & Son (N.J.)
Barber, F. F. Machinery Company (Ontario, Canada)
Baldwin Southwark Division (Pa.)
Baldwin Locomotive Works, The
Bawden Machine Co., Ltd., The (Ontario, Canada)
Birdsboro Steel Foundry & Machine Company (Pennsylvania)
Bolling, Stewart & Co. (Ohio)
Dorr Patterson Engr. Co. (Michigan)
Dunning & Boschert Press Co. (New York)
Elmes Engr. Wks. of Amer. Steel Foundries (Illinois)
Erie Engine & Mfg. Co. (Pa.)
Farquhar, A. B. Company (Pa.)
Farrel-Birmingham Co., Inc. (Conn.)
French Oil Well Machinery Co. (O.)
Gorski Bros. (Pa.)
Grant Research Laboratory (Ill.)
Hannifin Mfg. Co. (Ill.)
Hydraulic Press Mfg. Co. (O.)
Hy-Speed Press Co. Inc. (Ill.)
Improved Paper Machinery Corp. (New Hampshire)
Industrial Equipment Co., (N.J.)
Ingersoll Plastics Co. (N.J.)
Johnson City Foundry (Tenn.)
Kux Machine Co. (Ill.)
Lake Erie Engineering Corp. (N.Y.)
Loomis, Evarts G. Co. (N.J.)
McKinnon Iron Works Co. (Ohio)
Pomona Machine Works (California)
Preco, Inc. (California)
Reimuller Bros. Company (Illinois)
Rodgers Hydraulic, Inc. (Minnesota)
Royal Moulding Co. (Rhode Island)
Standard Machinery Co. (Conn.)
Stereotex Machinery Co. (Conn.)
Stokes, F. J. Machine Co. (Pa.)
Watson Stillman Co. (New Jersey)
Universal Hydraulic Machinery Co. (New York)
Williams, White & Co. (Illinois)
Wood, R. D. Co. (Pennsylvania)

Dehydrating

Albert, L. & Son (N.J.)
Baldwin Southwark Division (Pa.)
Baldwin Locomotive Works, The
Cavagnaro, John J., (N.J.)
Industrial Equipment Co. (N.J.)
First Machinery Corp. (New York)
French Oil Well Machinery Co. (O.)
Loomis, Evarts G. Co. (N.J.)
Preco, Inc. (California)
Universal Hydraulic Machinery Co. (New York)
Watson Stillman Co. (New Jersey)

Draw

Taber Instrument Corp. (New York)

Embossing

Ackerman-Gould Co. (N.Y.)
Acromark Company, The (N.J.)
Albert, L. & Son (N.J.)
Bliss, E. W. Company (N.Y.)
Cavagnaro, John J. (N.J.)
Denison Engineering Co. (Ohio)
Grant Research Laboratory (Ill.)
Lake Erie Engineering Corp. (N.Y.)
Loomis, Evarts G. Co. (N.J.)
National Rubber Machinery Co. (O.)
Preco, Inc. (California)
Royersford Foundry & Machine Co., Inc. (Pennsylvania)
Simplex Gold Stamping Press Co. (New York)
Standard Machinery Co. (Conn.)
Universal Hydraulic Machinery Co. (New York)
Vulcan Metalcraft Ltd. (Ont., Can.)
Waldron, John Corp. (New Jersey)
Watson Stillman Co. (New Jersey)
Williams, White & Co. (Illinois)
Wood, R. D. Co. (Pennsylvania)

Extruding

Albert, L. & Son (N.J.)
Bourke & Mabee (Ont., Can.)
Cavagnaro, John J. (N.J.)
Hydraulic Machinery Inc. (Mich.)
Hydraulic Press Mfg. Co. (Ohio)
Industrial Equipment Co. (N.J.)
Loomis, Evarts G. Co. (N.J.)
*Midwest Production Machine Co. (Ohio)
Preco, Inc. (California)
Royle, John & Sons (New Jersey)
Universal Hydraulic Machinery Co. (New York)

Hobbing

Albert, L. & Son (N.J.)
Bawden Machine Co., Ltd., The (Ontario, Canada)
Doerfler, L. Mfg. Co., Inc. (N.J.)

MINIATURE POWER PLANT

when it fails . . . your product fails

If, in your product there's a compact little power plant—commonly called a spring—you depend on that spring to deliver mechanical power as planned. Its function may be active or passive, but it *must* perform when called upon. If it doesn't, the *product* is blamed, *not* the spring.

Insure your product's good reputation with springs from Accurate . . . where everything possible is done to give you springs you can depend upon. Our experienced spring engineers will help you be sure you have planned the right spring for the job... our skilled craftsmen and modern machinery assure you of fine workmanship . . . and, careful testing through critical stages of manufacture will give you springs that you can rely on to function well and long. Call us. We'd like to work with you.

Accurate— for springs that won't let your product down

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[MACHINERY, PRESSES] Cont.

Dunning & Boschert Press Co. (New York)
Elmes Engr. Wks. of Amer. Steel Foundries (Illinois)
Farqubar, A. B. Company (Pa.)
Grant Research Laboratory (Ill.)
Hydraulic Press Mfg. Co. (O.)
Industrial Equipment Co. (N.J.)
Lake Erie Engineering Corp. (N.Y.)
Stricker-Brunhuber Co. (New York)
Universal Hydraulic Machinery Co. (New York)
Watson Stillman Co. (New Jersey)
Williams, White & Co. (Illinois)

Hydraulic pressure boosters

Albert, L. & Son (N.J.)
Electric Heater Co., The (Conn.)
Francis, Charles E. Co. (Ind.)
Hydraulic Machinery Inc. (Mich.)
Hy-Speed Press Co. Inc. (Ill.)
Progressive Welder Co. (Michigan)
Universal Hydraulic Machinery Co. (New York)
Watson Stillman Co. (New Jersey)

Injection

Barber, F. F. Machinery Company (Ontario, Canada)
Bawden Machine Co., Ltd., The (Ontario, Canada)
Brosites Machine Co., Inc. (N.Y.)
De Mattia Machine & Tool Co. (New Jersey)
Hisgen Machine Tool Wks. (Cal.)
Hydraulic Press Mfg. Co. (Ohio)
Hy-Speed Press Co., Inc. (Ill.)
Improved Paper Machinery Corp. (New Hampshire)
*Jandor Manufacturing Co. (Ill.)
Leominster Tool Co., Inc. (Mass.)
Lester Engineering Co. (O.)
Lester-Phoenix, Inc. (O.)
*Loomis, Evarts G. Co. (New Jersey)
McNeil Molding Machine Co., Inc. (Illinois)
Modern Die & Mold Co. (Ill.)
Munton Mfg. Co. (Ill.)
Reed-Prentice Corp. (Massachusetts)
Sav-Way Industries (Michigan)
Universal Hydraulic Machinery Co. (New York)
**Van Dorn Iron Works Co., (Ohio)
Watson Stillman Co. (New Jersey)

Jet

Hydraulic Press Mfg. Co. (O.)
Hy-Speed Press Co. Inc. (Ill.)
Lake Erie Engineering Corp. (N.Y.)
Lester-Phoenix, Inc. (O.)

Laminating

Adamson United Co. (Ill.)
Albert, L. & Son (N.J.)
Baldwin Southwark Division (Pa.)
Birdsboro Steel Foundry & Machine Company (Pennsylvania)
Bliss, E. W. Company (N.Y.)
Cedar-West Tool Co., Inc. (N.Y.)
Farrel-Birmingham Co., Inc. (Conn.)
Francis, Chas. E. Co. (Ind.)
French Oil Mill Machinery Co. (O.)
Grant Research Laboratory (Ill.)
Hydraulic Press Mfg. Co. (O.)
Johnson City Foundry (Tenn.)
** Kingshacher-Murphy Co. (Calif.)
Lake Erie Engineering Corp. (N.Y.)
Loomis, Evarts G. Co. (New Jersey)
Merritt Engineering and Sales Co., Inc. (New York)
Preco, Inc. (California)
Stricker-Brunhuber Co. (New York)
Universal Hydraulic Machinery Co. (New York)
Waldron, John Corp. (New Jersey)
Watson Stillman Co. (New Jersey)
Williams, White & Co. (Illinois)
Wood, R. D. Co. (Pennsylvania)

Mechanicel

Bawden Machine Co. (Ont., Can.)
Bliss, E. W. Company (N.Y.)
Cincinnati Shaper Co., The (O.)
Cleveland Punch & Shear Works Co. (Ohio)
Dunning & Boschert Press Co. (New York)
Improved Paper Machinery Corp. (New Hampshire)
Kux Machine Co. (Ill.)
Standard Machinery Co. (Conn.)
V & O Press Co., Inc. (New York)

Notching

V & O Press Co., Inc. (New York)

Pneumatic Preheeting

Stereotex Machincry Co. (Conn.)

Polking

Standard Tool Co. (Massachusetts)
Universal Hydraulic Machinery Co. (New York)

Preforming

Albert, L. & Son (N.J.)
Bliss, E. W. Company (N.Y.)
Denison Engineering Co. (Ohio)
Improved Paper Machinery Corp. (New Hampshire)
Industrial Equipment Co. (N.J.)

[MACHINERY, PRESSES] Cont.

Kux Machine Co., (Ill.)
Preco, Inc. Calif.)
Stokes, F. J. Machine Co. (Pa.)
Universal Hydraulic Machinery Co. (New York)
Vulcan Metalcraft Ltd. (Ont., Can.)
Watson Stillman Co. (New Jersey)
Wood, R. D. Co. (Pennsylvania)

Punch

Albert, L. & Son (N.J.)
*Aircraft Tools, Inc. (California)
Barber, F. F. Machinery Company (Ontario, Canada)
Bawden Machine Co. (Ont., Can.)
Bliss, E. W. Company (N.Y.)
Bourke & Mabee (Ont., Can.)
Cedar-West Tool Co., Inc. (N.Y.)
Cleveland Punch & Shear Works Co. (Ohio)
*Henry & Wright Mfg. Co. (Conn.)
*Holm's Manufacturing Co. (Wis.)
Niagara Machine & Tool Works (New York)
Royersford Foundry & Machine Co., Inc. (Pennsylvania)
Stricker-Brunhuber Co. (New York)
V & O Press Co., Inc., The (N.Y.)
Walsh Press & Die Co. (Illinois)

Roll leef & hot stamping

Ackerman-Gould Co. (N.Y.)
Acromark Company, The (N.J.)
Atlas Roll Leaf Corp. (N.Y.)
Bliss, E. W. Company (N.Y.)
Coughlin Manufacturing Co. (N.Y.)
Denison Engineering Co. (Ohio)
Kingsley Stamping Machine Co. (Calif.)
Markem Machine Co. (N.H.)
Peerless Roll Leaf Co., Inc. (N.J.)
Standard Tool Co. (Massachusetts)
Vulcan Metalcraft Ltd. (Ont., Can.)
Wood, R. D. Co. (Pennsylvania)

Steeping

Hydraulic Press Mfg. Co. (O.)
French Oil Well Machinery Co. (O.)

Tablet preforming

Albert, L. & Son (N.J.)
Colton, Arthur Company (Mich.)
Defiance Machine Works, Inc. (Ohio)
Denison Engineering Co. (Ohio)
Industrial Equipment Co. (N.J.)
Kux Machine Co. (Ill.)
First Machinery Corp. (New York)
Preco, Inc. (Calif.)
Royal Moulding Co. (Rhode Island)
Stokes, F. J. Machine Co. (Pa.)
Universal Hydraulic Machinery Co. (New York)
Watson Stillman Co. (New Jersey)

Toggle

Albert, L. & Son (N.J.)
Bliss, E. W. Company (N.Y.)
Cleveland Punch & Shear Works Co. (Ohio)
Dunning & Boschert Press Co. (New York)
Hannifin Mfg. Co. (Ill.)
Improved Paper Machinery Corp. (New Hampshire)
Kux Machine Co. (Ill.)
Leominster Tool Co., Inc. (Mass.)
First Machinery Corp. (New York)
Royal Moulding Co. (Rhode Island)
Standard Machinery Co. (Conn.)
Stokes, F. J. Machine Co. (Pa.)
Universal Hydraulic Machinery Co. (New York)
V & O Press Co., Inc., The (N.Y.)
Walsh Press & Die Co. (Illinois)

Transfer

Albert, L. & Son (N.J.)
Bliss, E. W. Company (N.Y.)
Defiance Machine Works, Inc. (Ohio)
Dunning & Boschert Press Co. (New York)
Elmes Engr. Wks. of Amer. Steel Foundries (Ill.)
Gorski Bros. (Pa.)
Grant Research Laboratory (Ill.)
Hydraulic Press Mfg. Co. (O.)
Improved Paper Machinery Corp. (New Hampshire)
Industrial Equipment Co. (N.J.)
Johnson City Foundry (Tenn.)
Lake Erie Engineering Corp. (N.Y.)
McNeil Molding Machine Co., Inc. (Illinois)
Baldwin Southwark Division (Pa.)
Birdsboro Steel Foundry & Machine Company (Pennsylvania)
French Oil Well Machinery Co. (O.)
Rodgers Hydraulic, Inc. (Minnesota)
Standard Machinery Co. (Conn.)
Standard Tool Co. (Massachusetts)
Stokes, F. J. Machine Co. (Pa.)
Universal Hydraulic Machinery Co. (New York)
Watson Stillman Co. (New Jersey)

Veneer

Adamson United Co. (Ill.)
Albert, L. & Son (N.J.)
Dunning & Boschert Press Co. (New York)

[MACHINERY, PRESSES] Cont.

Elmes Engr. Wks. of Amer. Steel Foundries (Illinois)
Farrell-Birmingham Co., Inc. (Conn.)
Francis, Chas. E. Co. (Ind.)
French Oil Mill Machinery Co. (O.)
Grant Research Laboratory (Ill.)
Hydraulic Press Mfg. Co. (O.)
Lake Erie Engineering Corp. (N.Y.)
Loomis, Evarts G. Co. (N.J.)
Merrit Engineering & Sales Co., Inc. (New York)
Rodgers Hydraulic, Inc. (Minnesota)
Universal Hydraulic Machinery Co. (New York)
Watson Stillman Co. (New Jersey)
Williams, White & Co. (Illinois)
Wood, R. D. Co. (Pennsylvania)

RAW MATERIAL COMPOUNDING

Automatic slicing

Albert, L. & Son (N.J.)
Loomis, Evarts G. Co. (N.J.)

Ball milling

Abbé Engineering Co. (N.Y.)
Abbé, Paul O. Inc. (N.J.)
Albert, L. & Son (N.J.)
Biggs Boiler Works Co., The (Ohio)
International Engineering, Inc. (O.)
Patterson Foundry & Machine (O.)
Porter, H. K. Co., Inc. (Pa.)
Proctor & Schwartz, Inc. (Pa.)

Chemical processing

American Products Mfg. Co. (La.)
Blaw-Knox Company (Pa.)
Edge Moor Iron Works (Del.)
Patterson Foundry & Machine Co., The (Ohio)
Read Machinery Co., Inc. (Pa.)

Condenser

Blaw-Knox Company (Pa.)

Crusher

Abbé Engineering Co. (N.Y.)
Albert, L. & Son (N.J.)
Devine, J. P. Mfg. Co., Inc. (Ill.)
Gruendler Crusher & Pulverizer Co. (Illinois)
First Machinery Corp. (New York)
Improved Paper Machinery Corp., (New Hampshire)
Mitts & Merrill (Mich.)
Sprout, Waldron & Co. (Pa.)
Union Steam Pump Co. (Michigan)
Pulverizing Machinery Co. (N.J.)

Cut-off

Albert, L. & Son (N.J.)
Crescent Machine Co., The (Ohio)
Peerless Machine Company (Wis.)

Disintegrator

Abbé, Paul O. Inc. (N.J.)
Albert, L. & Son (N.J.)
Ball & Jewell (N.Y.)
First Machinery Corp. (New York)
Patterson Foundry & Machine Co., The (Ohio)
Pulverizing Machinery Co. (N.J.)
Raymond Pulverizer, Div. Combustion Engineering Co., Inc. (Ill.)
Sprout, Waldron & Co. (Pa.)

Distilletion

Blaw-Knox Company (Pa.)
Edge Moor Iron Works (Del.)
First Machinery Corp. (New York)
Laboratory Specialties, Inc. (Ind.)

Dryer

Albert, L. & Son (N.J.)
Baker Perkins Inc. (Mich.)
Blaw-Knox Company (Pa.)
Coe Mfg. Co. (Ohio)
Despatch Oven Co. (Minn.)
Innis, Speiden & Co. (N.Y.)
Johnson City Foundry (Tenn.)
Koch, George, Sons, Inc. (Ind.)
Lydon Brothers (N.J.)
Patterson Foundry & Machine Co., The (Ohio)
Porter, H. K. Co., Inc. (Pa.)
Swenson Evaporator Co. (Ill.)

Eveporator

Blaw-Knox Company (Pa.)
Edge Moor Iron Works (Del.)

Filter

First Machinery Corp. (New York)
Loomis, Evarts G. Co. (N.J.)

Granulating

Abbé Engineering Co. (N.Y.)
American Pulverizer Co. (Mo.)
Ball & Jewell (N.Y.)
Cumberland Engineering Co. (R.I.)
First Machinery Corp. (New York)
Gruendler Crusher & Pulverizer Co. (Illinois)
Loomis, Evarts G. Co. (New Jersey)
Mitts & Merrill (Mich.)
National Rubber Machinery Co. (O.)
Patterson Foundry & Machine Co., The (Ohio)
Pulverizing Machinery Co. (N.J.)
Sprout, Waldron & Co. (Pa.)

[MACH., RAW MATERIAL] Cont.

Granule Blending

First Macninery Corp. (New York)
Patterson Foundry & Machine Co., The (Ohio)
Read Machinery Co., Inc. (Pa.)
Sprout, Waldron & Co. (Pa.)

Heat exchanger

Blaw-Knox Company (Pa.)
Edge Moor Iron Works (Del.)
Porter, H. K. Co., Inc. (Pa.)

High-speed hammer mill

First Machinery Corp. (New York)
Gruendler Crusher & Pulverizer Co. (Illinois)
Mitts & Merrill (Mich.)
Pulverizing Machinery Co. (N.J.)
Raymond Pulverizer, Div. Combustion Engineering Co., Inc. (Ill.)

Kettles, Synthesizing

Patterson Foundry & Machine Co., The (Ohio)

Kneading

Abbé, Paul O. Inc. (N.J.)
Adamson United Co. (Ill.)
Albert, L. & Son (N.J.)
Baker Perkins, Inc. (Mich.)
Cavagnaro, John J. (N.J.)
Day, J. H. Co. (Ohio)
Farrell-Birmingham Co., Inc. (Conn.)
First Machinery Corp. (New York)
Loomis, Evarts G. Co. (New Jersey
Patterson Foundry & Machine (O.)
Read Machinery Co., Inc. (Pa.)
Struthers Wells Corp. (Pa.)

Mixing

Abbé, Paul O. Inc. (N.J.)
Adamson United Co. (Ill.)
Albert, L. & Son (N.J.)
Baker Perkins Inc. (Mich.) Chemical Machinery Div.
Biggs Boiler Works Co., The (Ohio)
Blaw-Knox Company (Pa.)
Cavagnaro, John J. (N.J.)
Day, J. H. Co. (Ohio)
Edge Moor Iron Works (Del.)
Farrel-Birmingham Co., Inc. (Conn.)
First Machinery Corp. (New York)
Gruendler Crusher & Pulverizer Co. (Illinois)
Johnson City Foundry (Tenn.)
Loomis, Evarts G. Co. (New Jersey)
Patterson Foundry & Machine Co., The (Ohio)
Porter, H. K. Co., Inc. (Pa.)
Read Machinery Co., Inc. (Pa.)
Sprout, Waldron & Co. (Pa.)

Plents for resin manufecture

Blaw-Knox Company (Pa.)

Pulverizing

First Machinery Corp. (New York)
International Engineering, Inc. (O.)
Raymond Pulverizer, Div. Combustion Engineering Co., Inc. (Ill.)

Reection equipment

Blaw-Knox Company (Pa.)

Ribbon blender

Abbé, Paul O. Inc. (N.J.)
Albert, L. & Son (N.J.)
Edge Moor Iron Works (Del.)
First Machinery Corp. (New York)
Gruendler Crusher & Pulverizer Co. (Illinois)
International Engineering, Inc. (O.)
Porter, H. K. Co., Inc. (Pa.)
Read Machinery Co., Inc. (Pa.)

Roll mill

Adamson United Co. (Ill.)
Albert, L. & Son (N.J.)
Bawden Machine Co., Ltd., The (Ontario, Canada)
Day, J. H. Co., The (Ohio)
Erie Engine & Mfg. Co. (Pa.)
Farrel-Birmingham Co., Inc. (Conn.)
First Machinery Corp. (New York)
Grant Research Laboratory (Ill.)
Gruendler Crusher & Pulverizer Co. (Illinois)
Loomis, Evarts G. Co. (New Jersey)
National Rubber Machinery Co. (O.)
Sprout, Waldron & Co. (Pa.)
Stewart Bolling & Co., Inc. (Ohio)
Universal Hydraulic Machinery Co. (New York)

Sifter

Abbé Engineering Co. (N.Y.)
Albert, L. & Son (N.J.)
Day, J. H. Co., The (Ohio)
First Machinery Co. (New York)
Gruendler Crusher & Pulverizer Co. (Illinois)
Patterson Foundry & Machine Co., The (Ohio)
Read Machinery Co., Inc. (Pa.)
Sprout, Waldron & Co. (Pa.)

Solvent recovery

Albert, L. & Son (N.J.)
American Products Mfg. Co. (La.)
Blaw-Knox Company (Pa.)
Edge Moor Iron Works (Del.)

* Indicates laboratory equipment; ** Indicates both laboretory and production equipment.

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Opening many new uses for plastics, Eclipse now offers you facilities for successfully producing parts larger than any presently manufactured.

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FIELD BUILDING, CHICAGO 90, ILLINOIS

COMPRESSION • INJECTION • MOULDING IN ALL PLASTIC MATERIALS

[MACH., RAW MATERIAL] Cont.

Vacuum mixer
Ahbé, Paul O. Inc. (N.J.)
Albert, L. & Son (N.J.)
Baker Perkins Inc. (Mich.) Chemical Machinery Div.
Blaw-Knox Company (Pa.)
Cavagnaro, John J. (N.J.)
First Machinery Corp. (New York)
International Engineering, Inc. (O.)
Loomis, Evarts G. Co. (N.J.)
Patterson Foundry & Machine Co., The (Ohio)
Read Machinery Co., Inc. (Pa.)
Youngstown Miller Co. (New Jersey)

COATING

Air compressor
Albert, L. & Son (N.J.)
Allis-Chalmers Mfg. Co. (Wis.)
Curtis Refrigerator Machine Div. (Missouri)
DeVilhiss Co., The (Ohio)
Miller-Simons, Inc. (Illinois)
Nash Engineering Co. (Conn.)
Paasche Airbrush Co. (Illinois)

Calendering
Adamson United Co. (Ill.)
Albert, L. & Son (N.J.)
Farrel-Birmingham Co., Inc. (Conn.)
Grant Research Laboratory (Ill.)
Loomis, Evarts G. Co. (N.J.)
National Rubber Machinery Co. (O.)
Universal Hydraulic Machinery Co. (New York)

Centrifugal lacquer coater
Barrett, Leon J. Co. (Mass.)
Electric Heater Co., The (Conn.)

Chrome-plating
American Name Plate & Mfg. Co. (Illinois.)
Hanson-Van Winkle-Munning Co. (New Jersey)
Munning & Munning, Inc. (N.J.)
Wickman, A. C., Ltd. (Ont., Can.)

Coating
Bird & Son, Inc. (Massachusetts)
Francis, Chas. E. Co. (Ind.)
Industrial Oven Engr. Co. (Ohio)
Plastic Lining Corporation (Illinois)
*Precision Scientific Co. (Illinois)
Ross, J. O. Engineering Corp. (N.Y.)
Universal Hydraulic Machinery Co. (New York)
Waldron, John Corp. (New Jersey)

Convection paint, lacquer drying oven
Blodgett, G. S. Co., Inc. (Vt.)
Industrial Oven Engr. Co. (Ohio)
Koch, George, Sons, Inc. (Ind.)
Lydon Brothers (N.J.)
Paasche Airbrush Co. (Illinois)
Rockwell, W. S. Company (Conn.)
Ross, J. O. Engineering Corp. (N.Y.)
Trent, Harold E. (Pennsylvania)
Young & Bertke Co. (Ohio)
Young Brothers Co. (Michigan)

Dip tank
Aeroil Products Company (N.J.)
Albert, L. & Son (N.J.)
Industrial Oven Engineering Co., The (Ohio)
Young & Bertke Co. (Ohio)
Young Brothers Co. (Michigan)
Youngstown Miller Co. (New Jersey)

Electroplating
American Name Plate & Mfg. Co. (Illinois)
Federal Telephone and Radio Corp. (New Jersey)
Munning & Munning, Inc. (N.J.)

Glue spreader (padder)
Albert, L. & Son (N.J.)
Industrial Oven Engineering Co., The (Ohio)

Infra-red drying oven
Despatch Oven Co. (Minn.)
Industrial Oven Engineering Co., The (Ohio)
Infra-Red Engrs. & Designers (O.)
No. American Elec. Lamp Co. (Mo.)
Paasche Airbrush Co. (Illinois)
Rockwell, W. S. Company (Conn.)
Ross, J. O. Engineering Corp. (N.Y.)
Young & Bertke Co. (Ohio)
Young Brothers Co. (Michigan)

Knife-Coating
Ross, J. O. Engineering Corp. (N.Y.)
Waldron, John Corp. (New Jersey)

Plating
Hanson-Van Winkle-Munning Co. (New Jersey)

Pump
Albert, L. & Son (N.J.)
Allis-Chalmers Mfg. Co. (Wis.)
Porter, H. K. Co., Inc. (Pa.)
Universal Hydraulic Machinery Co. (New York)

[MACHINERY, COATING] Cont.

Roll coating
Farrel-Birmingham Co., Inc. (Conn.)
Francis, Chas. E. Co. (Ind.)
Industrial Oven Engr. Co. (Ohio)
Raybestos-Manhattan, Inc. (N.J.)
Waldron, John Corp. (New Jersey)

Spraying
Aeroil Products Company (N.J.)
Baldwin Locomotive Works, The (Pa.)
Binks Mfg. Co. (Illinois)
DeVilhiss Co., The (Ohio)
Eclipse Air Brush Co., Inc. (N.J.)
Electric Heater Co., The (Conn.)
First Machinery Corp. (New York)
Hockaday Aircraft Corp. (Calif.)
Milhurn, Alexander Co. (Md.)
Miller-Simons, Inc. (Illinois)
Minnesota Mining & Mfg. (Minn.)
Nooter, John Boiler Works Co. (Mo.)
Paasche Airbrush Co. (Illinois)
Spray Engineering Co. (Mass.)

Tank, rubber lined
Buffalo Tank Corp. (New Jersey)
Electric Heater Co., The (Conn.)
Raybestos-Manhattan, Inc. (N.J.)

LAMINATING, IMPREGNATING

Autoclave
Adamson United Co. (Ill.)
Albert, L. & Son (N.J.)
Baldwin Southwark Division (Pa.)
Biggs Boiler Works Co., The (Ohio)
Devine, J. P. Mfg. Co., Inc. (Ill.)
Edge Moor Iron Works (Del.)
Electric Heater Co., The (Conn.)
First Machinery Corp. (New York)
International Engineering, Inc. (O.)
Loomis, Evarts G. Co. (New Jersey)
Midvale Company, The (Pa.)
Patterson Foundry & Machine Co., The (Ohio)
Porter, H. K. Co., Inc. (Pa.)
*Precision Scientific Co. (Illinois)
Struthers Wells Corp. (Pa.)
Universal Hydraulic Machinery Co. (New York)

Bag Mold
Biggs Boiler Works Co., The (Ohio)

Dip tank
Albert, L. & Son (N.J.)
Biggs Boiler Works Co., The (Ohio)
Buffalo Tank Corp. (New Jersey)
Detrex Corp. (Michigan)
Devine, J. P. Mfg. Co., Inc. (Ill.)
International Engineering, Inc. (O.)

Dryer, convection
Albert, L. & Son (N.J.)
Blodgett, G. S. Co. Inc. (Va.)
Brosites Machine Co., Inc. (N.Y.)
Despatch Oven Co. (Minn.)
Industrial Oven Engineering Co., The (Ohio)
Koch, George, Sons Inc. (Ind.)
Lydon Brothers (N.J.)
Rockwell, W. S. Company (Conn.)
Ross, J. O. Engineering Corp. (N.Y.)
Trent, Harold E. (Pennsylvania)
Young Brothers Co. (Michigan)

Dryer, radiant
Despatch Oven Co. (Minn.)
Fostoria Pressed Steel Corp. (O.)
No. American Elec. Lamp Co. (Mo.)
Paasche Airbrush Co. (Illinois)
Rockwell, W. S. Company (Conn.)
Ross, J. O. Engineering Corp. (N.Y.)
Techtmann Industries, Inc. (Wis.)
Young Brothers Co. (Michigan)

Glue Heater
Albert, L. & Son (N.J.)
Devine, J. P. Mfg. Co., Inc. (Ill.)
Edge Moor Iron Works (Del.)
Electric Heater Co., The (Conn.)
Francis, Chas. E. Co. (Ind.)
New Advance Machinery Co. (Ohio)

Impregnating Systems
Barrett, Leon J. Co. (Massachusetts)
Blaw-Knox Company (Pennsylvania)
Stokes, F. J. Machine Co. (Pa.)

Knifing
Albert, L. & Son (N.J.)
Industrial Oven Engineering Co., The (Ohio)
Ross, J. O. Engineering Corp. (N.Y.)

Platen
Adamson United Co. (Ill.)
Albert, L. & Son (N.J.)
Raybestos-Manhattan, Inc. (N.J.)
Universal Hydraulic Machinery Co. (New York)
Wood, R. D. Co. (Pennsylvania)

Squeeze roll
Albert, L. & Son (N.J.)
Industrial Oven Engineering Co., The (Ohio)
Ross, J. O. Engineering Corp. (N.Y.)

[MACHINERY, LAMINATING] Cont.

Treater
Industrial Oven Engineering Co., The (Ohio)
Ross, J. O. Engineering Corp. (N.Y.)
Waldron, John Corp. (N.J.)

Vacuum filter
Dollinger Corp. (N.Y.)

Vacuum Gages
Stokes, F. J. Machine Co. (Pa.)

Vacuum pump accessories
Albert, L. & Son (N.J.)
Allis-Chalmers Mfg. Co. (Wis.)
Devine, J. P. Manufacturing Co., Inc. (Illinois)
First Machinery Corp. (N.Y.)
Kinney Mfg. Co. (Mass.)
Laboratory Specialties, Inc. (Ind.)
Lammert and Mann Co. (Ill.)
Leiman Bros., Inc. (N.J.)
Merritt Engineering & Sales Co., Inc. (New York)
Nash Engineering Co. (Conn.)
Pennsylvania Pump & Compressor Co. (Pa.)
Porter, H. K. Co., Inc. (Pa.)
Stokes, F. J. Machine Co. (Pa.)
Union Steam Pump Co. (Mich.)
Worthington Pump & Machinery Corp. (N.J.)

Vacuum tank
Buffalo Tank Corp. (N.J.)
Edge Moor Iron Works (Del.)
Lammert and Mann Co. (Ill.)
Stokes, F. J. Machine Co. (Pa.)
Struthers Wells Corp. (Pa.)

ELECTRONIC HEATING EQPT.

Acro Comunications, Inc. (N.Y.)
Airtronics Manufacturing Company (Calif.)
Ajax Electrothermic Corp. (N.J.)
Allis-Chalmers Mfg. Co. (Wis.)
Amaron Manufacturing Corporation (Calif.)
Barker & Williamson (Pa.)
Belmont Radio Corp. (Ill.)
Branston Electric Mfg. Co. (N.Y.)
Budd Induction Heating, Inc. (Mich.)
Bunnell, J. H. & Co. (N.Y.)
Burdick Corporation, The (Wis.)
Cyclonics Mfg. Co., Inc. (N.J.)
De Forest, Lee Labs. (Calif.)
Ecco High Frequency Electric Corp. (New Jersey)
Federal Electric Co., Inc. (Ill.)
Federal Telephone and Radio Corp. (New Jersey)
Girdler Corp., The (Ky.) Thermex Division
H & A Manufacturing Co., Inc. (New York)
Illinois Tool Works, Electronics Div. (Illinois)
Induction Heating Corp. (N.Y.)
**Industrial Machinery Co. (N.J.)
Intra-Therm Corporation (Iowa)
Johnson, E. F. Co. (Minn.)
Kurman Electric Co. (N.Y.)
LaRose, W. T. Co. (N.Y.)
Lepel High Frequency Laboratories, Inc. (N.Y.)
Northwest Syndicate, Inc. (Wash.)
Ohio Crankshaft Co., The (Ohio)
Operadio Mfg. Co. (Ill).
*Precision Scientific Co. (Ill.)
Radio Frequency Labs., Inc. (N.J.)
Radio Receptor Co., Inc. (N.Y.)
Ripley Company, The (Conn.)
"S" Corrugated Quenched Gap Co. (N.J.)
Sherron Metallic Corp. (N.Y.)
Sylvania Electronics Products, Inc. (N.Y.)
United Cinephone Corp. (Conn.)
United Electronics Co. (N.J.)
Westinghouse Electric Corp. (Pa.)
Wiegand, Edwin L. Co. (Pa.)

SUPPLIES

Abrasive discs
Gardner Machine Co. (Wis.)

Abrasive materials
American Rotary Tools Company, Inc. (New York)
Bourke & Mabee (Ont., Can.)
Bridgeport Safety Emery Wheel Co., Inc. (Connecticut)
Burns, E. Reed Mfg. Corp. (N.Y.)
Clover Mfg. Co. (Conn.)
Divine Brothers Co. (N.Y.)
DoAll Co., The (Minn.)
Eagle Grinding Wheel Co. (Ill.)
Formax Mfg. Co. (Mich.)
Griffiths, K. F. & Co. Inc. (N.Y.)
Hanson-Van Winkle-Munning Co. (New Jersey)
Innis, Speiden & Co. (N.Y.)
Lea Manufacturing Co., The (Conn.)
Manderscheid Company, The (Ill.)
McAleer Manufacturing Co. (Mich.)

[MACHINERY, SUPPLIES] Cont.

Mead Specialties Co. (Ill.)
Minnesota Mining & Mfg. Co. (Minnesota)
Neal & Brinker Co. (N.Y.)
Norton Company (Mass.)
Precise Product Co. (Wis.)
Severance Tool Industries, Inc. (Michigan)
United Laboratories Co. (N.J.)
Wagner, Charles A. Co., Inc. (Pa.)

Attachments for lathes
Enco Manufacturing Co. (Ill.)

Bearings
Albert, L. & Son (N.J.)
Carboloy Company, Inc. (Mich.)
Colonial Bushings, Inc. (Mich.)
Raybestos-Manhattan, Inc. (N.J.)

Belts, belting
American Rotary Tools Company, Inc. (New York)
Hewitt Rubber Corp. (N.Y.)
Production Machine Co. (Mass.)
Raybestos-Manhattan, Inc. (N.J.)

Buffing, polishing compounds
Acro Tool & Die Works (Ill.)
American Rotary Tools Co. (N.Y.)
Belke Mfg. Co. (Ill.)
Burns, E. Reed Mfg. Corp. (N.Y.)
Canadian Hanson & Van Winkle Co. Limited (Ontario, Canada)
Divine Brothers Co. (N.Y.)
Formax Mfg. Co. (Mich.)
Great American Color Co. (Calif.)
Griffiths, K. F. & Co. Inc. (N.Y.)
Hanson-Van Winkle-Munning Co. (New Jersey)
Innis, Speiden & Co. (N.Y.)
Lea Manufacturing Co., The (Conn.)
Manderscheid Company, The (Ill.)
McAleer Manufacturing Co. (Mich.)
Minnesota Mining & Mfg. Co. (Minnesota)
Frederic B. Stevens, Inc. (Mich.)
United Laboratories Co. (N.J.)
Universal Tumbling Compounds (N.Y.)

Bushings
Aircraft Screw Products Company, Inc. (New York)
Carboloy Company, Inc. (Mich.)
Colonial Bushings, Inc. (Mich.)
Industrial Research Laboratories, Ltd. (Calif.)
Raybestos-Manhattan, Inc. (N.J.)
Wickman, A. C. Ltd. (Ont., Can.)

Carbide & cast alloys
Jessop Steel Co. (Pa.)

Chemicals (for electroplating)
Special Chemicals Co. (N.Y.)

Chucks
American Rotary Tools Company, Inc. (N.Y.)
Bourke & Mahee (Ont., Can.)
Errington Mechanical Lab. (N.Y.)
Logansport Machine Co., Inc. (Ind.)
Westcott Chuck Company (N.Y.)
Woodworth, N. A. Co. (Mich.)

Clamps
Adjustable Clamp Co. (Ill.)
Detroit Stamping Co. (Mich.)
Grand Specialties Co. (Ill.)
Knu-Vise, Inc. (Mich.)
Leominster Tool Co., Inc. (Mass.)
Mead Specialties Co. (Ill.)
Mechanics Engineering Co. (Mich.)
Tinnerman Products, Inc. (Ohio)

Cleaner
Amaron Manufacturing Corporation (Calif.)
McAleer Manufacturing Co. (Mich.)
Merix Anti-Fog (Ill.)

Couplings
Albert, L. & Son (N.J.)
Barber, F. F. Machinery Company (Ontario, Canada)
Eclipse-Pioneer Division (N.J.) Bendix Aviation Corporation
Farrel-Birmingham Co., Inc. (Conn.)
Independent Pneumatic Tool Co. (Illinois)
Lovejoy Flexible Coupling Co. (Ill.)
Paasche Airbrush Co. (Ill.)

Fastening devices
Accurate Threaded Fasteners (Ill.)
Adjustable Clamp Co. (Ill.)
American Screw Co. (R.I.)
Boots Aircraft Nut Corp. (Conn.)
Central Screw Company (Ill.)
Cherry Rivet Company (Calif.)
Continental Screw Co. (Mass.)
Dzus Fastener Company, Inc. (N.Y.)
Grand Specialties Co. (Ill.)
Hassall, John Inc. (N.Y.)
Illinois Tool Works, Electronics Div. (Illinois)
Industrial Screw Co., (Ill.)
Lamson & Sessions Co., The (O.)
Manufacturers Screw Products (Ill.)
Mechanics Engineering Co. (Mich.)
Milford Rivet & Machine Co. (Ohio)

* Indicates laboratory equipment; ** Indicates both laboratory and production equipment.

g. 1. Biggs autoclave with quick-opening door equipped ith special heating manifolds and circulating fan for con- ol of temperature gradients throughout the unit. . . . Fig. 2. pecial autoclave with quick-opening door for bag molding plastic bonded fabrics, metals, or molded plywood. Furnished in all sizes and for pressures up to 400 psi.

Biggs AUTOCLAVES AND MIXING KETTLES FOR THE PLASTICS INDUSTRY

FOR over 50 years "Biggs Built" equipment has served the chemical and allied processing industries. Today Biggs autoclaves, mixing kettles, and special welded steel and alloy pressure vessels are available in a variety of types and sizes for the efficient processing of plastics and resins.

Biggs autoclaves with quick-opening doors are in use for the pressure molding of thermoplastics and laminated phenolics. They can be furnished in single-shell construction with heating coils, baffles, and fans for controlling temperature gradients, or of jacketed construction, and in a wide range of sizes and working pressures.

Modern plant facilities guided by mature experiences are your assurance that Biggs is a reliable and dependable source of supply for many and varied types of special processing equipment. Our manufacturing facilities are at your disposal.

Fig. 3. Nickel-clad jacketed mixing kettle for the phenolic resin and chemical industries. . . . Fig. 4. Steam-jacketed laboratory reactor. Outside shell of carbon steel; inside shell 18-8 stainless steel. Special agitator . . . Fig. 5. Stainless steel welded kettle and condenser. Kettle is complete with removable cover and special agitators.

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Pond Engineering Co. (Mass.)
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Blaisdell Pencil Co. (Pa.)

[MACHINERY, SUPPLIES] Cont.

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Paint Sticks for Marking, Stamping

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Ziv Steel & Wire Co. (Ill.)

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Norton Company (Mass.)

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Norton Company (Mass.)
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Norton Company (Mass.)
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Severance Tool Industries, Inc. (Michigan)

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Ashing wheel

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Betilite Co. Inc. (N.J.)
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Jordan Industries (Ont., Can.)

[MACHINERY, FORMING] Cont.

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American Buff Company (Ill.)
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Hanson-Van Winkle-Munning Co. (New Jersey)
Haskins, R. G. Co. (Ill.)
Hisey-Wolf Machine Co. (Ohio)
Holm's Mfg. Company (Wis.)
Independent Pneumatic Tool Co. (Illinois)
Jackson Buff Corporation (N.Y.)
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Lea Manufacturing Co., The (Conn.)
Leominster Tool Co., Inc. (Mass.)
McAleer Manufacturing Co. (Mich.)
Munning & Munning, Inc. (N.J.)
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Packer Machine Co. (Conn.)
Precise Product Company (Wis.)
Production Machine Co. (Mass.)
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Standard Tool Co. (Mass.)
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United Laboratories Co. (N.J.)
Van Dorn Electric Tool Co. (Md.)

Burring

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Barber, F. F. Machinery Company (Ontario, Canada)

[MACHINERY, FORMING] Cont.

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Hydraulic Machinery Inc. (Mich
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Invincible Tool Co. (Pa.)
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Lea Manufacturing Co., The (Conn
Mead Specialties Co. (Ill.)
Oliver Machinery Co. (Mich.)
Precise Product Company (Wis.)
Schauer Machine Company (Ohio)
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Standard Tool Co. (Mass.)
Stow Manufacturing Co. (N.Y.)
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Mitts & Merrill (Mich.)
Stow Manufacturing Co. (N.Y.)

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Albert, L. & Son (N.J.)
Allite Mfg. Company (Calif.)
American Emery Wheel Works (Rhode Island)
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Beech Manufacturing Company (Pa
Boice-Crane Company (Ohio)
Bourke & Mabee (Ont., Can.)
Carboloy Company, Inc. (Mich.)
Cincinnati Electrical Tool Co. (Ohio
DoAll Co., The (Minn.)
Eagle Grinding Wheel Co. (Ill.)
Electric Heater Co. The (Conn.)
Holm's Manufacturing Co. (Wis.)
Jordan Industries (Ont., Can.)
Neal & Brinker Co. (N.Y.)
Peck, Stow & Wilcox Co. (Conn.)
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Pond Engineering Co. (Mass.)
Raybestos-Manhattan, Inc. (N.J.)
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Allite Mfg. Company (Calif.)
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Boice-Crane Company (Ohio)
Bourke & Mabee (Ont., Can.)
Carboloy Company, Inc. (Mich.)
DoAll Co., The (Minn.)
Eagle Grinding Wheel Co. (Ill.)
Electric Heater Co., The (Conn.)
Ex-Cell-O Corp. (Mich.)
Ferriot Brothers, Inc. (Ohio)
Ford, M. A. Mfg. Co. Inc. (Ia.)
Genesee Tool Co. (Mich.)
Grobet File Co. of America (N.Y.)
Holm's Mfg. Company (Wis.)
Jordan Industries (Ont., Can.)
McCrosky Tool Corporation (Pa.)
Michigan Tool Co. (Mich.)
Morse Twist Drill & Machine Co. (Massachusetts)
National Bronze Studios (Calif.)
Onsrud Machine Works, Inc. (Ill.)
Peck, Stow & Wilcox Co. (Conn.)
Precise Product Co. (Wis.)
Spadone Machine Co. (N.Y.)
Tungsten Carhide Tool Co. (Mich.)
Vulcan Metalcraft Ltd. (Ont., Can.)
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Wickman, A. C. Ltd. (Ont., Can.)

Deep-drawing

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Hulbert Engineering Corp. (Wis.)
Hydraulic Machinery Inc. (Mich.)
Jordan Industries (Ont., Can.)
Wickman, A. C. Ltd. (Ont., Can.)

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Baldwin Locomotive Works, The
Birdshoro Steel Foundry & Machine (Pennsylvania)
Bourke & Mabee (Ont., Can.)
DoAll Co., (The (Minn.)
Henry & Wright Mfg. Co. (Conn.)
Ideal Commutator Dresser Co. (Ill.)
Luma Electric Equipment Co. (O.)
Reimuller Bros. Co. (Ill.)
Verson Allsteel Press Co. (Ill.)

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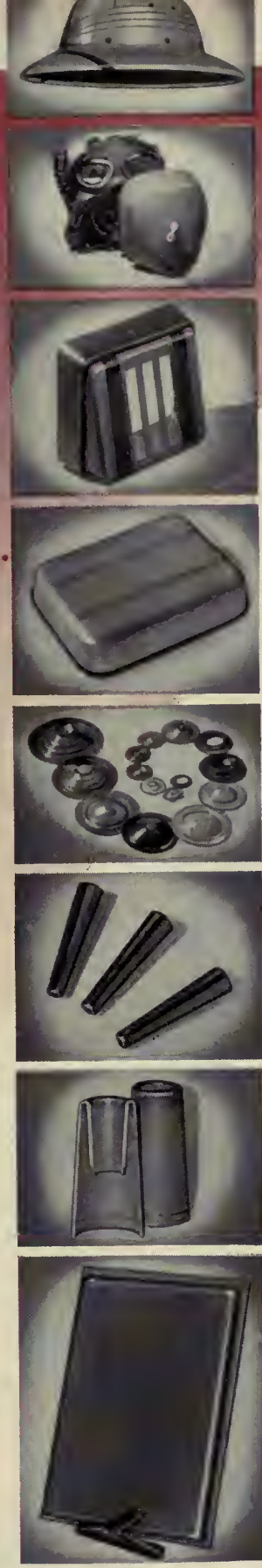
Accurate Steel-Rule Die Manufacturers (N.Y.)



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Gottscho, Adolph Inc. (N.Y.)
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Pannier Bros. Stamp Co. (Pa.)
New Method Steel Stamps, Inc. (Michigan)
Wright, Greg G. & Sons (N.Y.)

Die Shoe

Woshyna Plastic Mold Co. (Mich.)

Drawing

Able Machine and Tool Works (N.Y.)
Acme Marking Equipment Co. (Michigan)

Drill

Aaron Machinery Co. (N.Y.)
Ace Drill Corp. (Mich.)
Acro Tool & Die Works (Ill.)
Aircraft Tools, Inc. (Calif.)
Allite Mfg. Company (Calif.)
Ansonia Clock Company, Inc., The
Arclay Plastics Products (Calif.)
Aro Equipment Corp., The (Ohio)
Avery Drilling Machine Co., (Ky.)
Barber, F. F. Machinery Company (Ontario, Canada)
Betilite Co. Inc. (N.J.)
Black & Decker Mfg. Co., The (Md.)
Boice-Crane Company (Ohio)
Bourke & Mabee (Ont., Can.)
Buckeye Tools Corp. (Ohio)
Buffalo Forge Company (N.Y.)
Canedy Otto Mfg. Co. (Ill.)
Cincinnati Electrical Tool Co. (Ohio)
Cleveland Twist Drill Co. (Ohio)
Commander Manufacturing Co. (Ill.)
Dunmore Company, The (Wis.)
Electric Heater Co. The (Conn.)
Frew Machine Co., The (Pa.)
Greenfield Tap & Die Corp. (Mass.)
Grobet File Co. of America (N.Y.)
Hockaday Aircraft Corp. (Calif.)
Holm's Manufacturing Co. (Wis.)
Hydraulic Machinery Inc. (Mich.)
Independent Pneumatic Tool Co. (Illinois)
Invincible Tool (Co. (Penna.)
Jordan Industries (Ont., Can.)
Karelsen, E. Inc. (N.Y.)
Kett Tool Co., The (Ohio)
Mall Tool Company (Ill.)
Misener Mfg. Co., Inc. (N.Y.)
Morse Twist Drill & Machine Co. (Massachusetts)
National Bronze Studios (Calif.)
Neal & Brinker Co. (N.Y.)
Precise Product Co. (Wis.)
Skilsaw, Inc. (Ill.)
Standard Tool Co. (Mass.)
Stow Manufacturing Co. (N.Y.)
United States Electrical Tool Co. (Ohio)
Van Dorn Electric Tool Co. (Md.)
Walker-Turner Company, Inc. (N.J.)
Wickman, A. C. Ltd. (Ont., Can.)

Drill press

Acro Tool & Die Works (Ill.)
Aircraft Tools, Inc. (Calif.)
Allite Mfg. Company (Calif.)
Arclay Plastics Products (Calif.)
Atlas Press Company (Mich.)
Avery Drilling Machine Co., (Ky.)
Barber, F. F. Machinery Company (Ontario, Canada)
Betilite Co., Inc. (N.J.)
Boice-Crane Company (Ohio)
Bourke & Mabee (Ont., Can.)
Buffalo Forge Company (N.Y.)
Canedy Otto Mfg. Co. (Ill.)
Champion Blower & Forge Co. (Pa.)
Electric Heater Co., The (Conn.)
Frisch, Arthur Co. (N.Y.)
Gray Motor & Tool Co., Inc. (N.Y.)
Haskins, R. G. Co. (Ill.)
Henry & Wright Mfg. Co. (Conn.)
Hockaday Aircraft Corp. (Calif.)
Holm's Mfg. Company (Wis.)
Jordan Industries (Ont., Can.)
Laboratory Specialties, Inc. (Ind.)
Leominster Tool Co., Inc. (Mass.)
National Bronze Studios (Calif.)
Neal & Brinker Co. (N.Y.)
Pond Engineering Co. (Mass.)
Power King Tool Corp. (Ind.)
Royersford Foundry & Machine Co., Inc. (Pennsylvania)
Walker-Turner Company, Inc. (N.J.)
Woshyna Plastic Mold Co. (Mich.)

Drill press attachments

Invincible Tool Co. (Pa.)

Duplicator

Cincinnati Milling Machine Co., The (Ohio)
Gorton, George Machine Co. (Wis.)
Spiegel Sales Co. (Mich.)
Stricker-Brunhuber Co. (N.Y.)
Woshyna Plastic Mold Co. (Mich.)

[MACHINERY, FORMING] Cont.

Edging or trimming

Ajax-Doret Metal Products Limited (Ontario, Canada)
Apollo Metal Works (Ill.)
Aro Equipment Corp., The (Ohio)
Beech Manufacturing Co. (Pa.)
Boice-Crane Company (Ohio)
Jordan Industries (Ont., Can.)
Onsrud Machine Works, Inc. (Ill.)
Severance Tool Industries, Inc. (Michigan)
V & O Press Co., Inc., The (N.Y.)
Wickman, A. C. Ltd. (Ont., Can.)

Electrical etching

DoAll Co., The (Minn.)
Ideal Commutator Dresser Co. (Ill.)
Luma Electric Equipment Co. (O.)
Preis, H. P., Engraving Machine Co. (New Jersey)

Embossing

Ackerman-Gould Co. (N.Y.)
Acme Marking Equipment Co. (Michigan)
Acromark Company, The (N.J.)
Adams Company, S. G. (Mo.)
Baldwin Southwark Div. (Pa.) Baldwin Locomotive Works, The
Cavagnaro, John J. (N.J.)
Coughlin Mfg. Co. (N.Y.)
French Oil Well Machinery (Ohio)
Frisch, Arthur Co. (N.Y.)
Gottscho, Adolph Inc. (N.Y.)
Griffin, Campbell, Hayes, Walsh, Inc. (New York)
Lansky Die Cutting Co. (N.Y.)
Markem Machine Co. (N.H.)
Moss, Samuel H. Inc. (N.Y.)
New Method Steel Stamps, Inc. (Michigan)
Pannier Bros. Stamp Co. (Pa.)
Peerless Roll Leaf Co., Inc. (N.J.)
Simplex Gold Stamping Press Co. (New York)
Sossner Steel Stamps (N.Y.)
Universal Hydraulic Machinery Co. (New York)
Waldron, John Corp. (N.J.)
Wright, Greg G. & Sons (N.Y.)

Engraving

Ackerman-Gould Co. (N.Y.)
Acme Marking Equipment Co. (Michigan)
Acromark Company, The (N.J.)
Adams Company, S. G. (Mo.)
Auto Engraver Co. (N.Y.)
Calibrated Instruments (N.Y.)
Gorton, George Machine Co. (Wis.)
Jordan Industries (Ont., Can.)
Moss, Samuel H. Inc. (N.Y.)
New Method Steel Stamps, Inc. (Michigan)
Pannier Bros. Stamp Co. (Pa.)
Parker Stamp Works, Inc. (Conn.)
Precise Product Co. (Wis.)
Preis, H. P., Engraving Machine Co. (New Jersey)
Severance Tool Industries, Inc. (Michigan)
Stricker-Brunhuber Co. (N.Y.)
Thwing-Albert Instrument Co. (Ill.)
Woshyna Plastic Mold Co. (Mich.)
Wright, Greg G. & Sons (N.Y.)

Files

Aircraft Tools, Inc. (Calif.)
Ajax-Doret Metal Products Limited (Ontario, Canada)
Arclay Plastics Products (Calif.)
Atkins and Company, E. C. (Ind.)
Boice-Crane Company (Ohio)
Bourke & Mabee (Ont., Can.)
Cedar-West Tool Co., Inc. (N.Y.)
Chicago Precision Equipment Co. (Illinois)
Continental Machines, Inc. (Minn.)
DoAll Co., The (Minn.)
Disston, Henry & Sons, Inc. (Pa.)
Grobet File Co. of America (N.Y.)
Haskins, R. G. Co. (Ill.)
Holm's Mfg. Co. (Wis.)
Neal & Brinker Company (N.Y.)
Simonds Saw and Steel Co. (Mass.)
Stow Manufacturing Co. (N.Y.)
Wickman, A. C. Ltd. (Ont., Can.)
Woshyna Plastic Mold Co. (Mich.)

Finishing

Allite Mfg. Company (Calif.)
Arclay Plastics Products (Calif.)
Aro Equipment Corp., The (Ohio)
Boice-Crane Company (Ohio)
Coughlin Mfg. Co. (N.Y.)
DoAll Co., The (Minn.)
Hammond Machinery Builders Inc. (Michigan)
Innis, Speiden & Co. (N.Y.)
Jordan Industries (Ont., Can.)
Lea Manufacturing Co., The (Conn.)
McAleer Manufacturing Co. (Mich.)
Mead Specialties Co. (Ill.)
Paasche Airbrush Co. (Ill.)
Precise Product Co. (Wis.)
Reimuller Bros. Co. (Ill.)
Woshyna Plastic Mold Co. (Mich.)

[MACHINERY, FORMING] Cont.

Flow Meters

First Machinery Company (N.Y.)
Republic Flow Meters Co. (Ill.)

Gold, Silver Stamping

Simplex Gold Stamping Press Co. (New York)

Grinding

Aircraft Tools, Inc. (Calif.)
Ajax-Doret Metal Products Limited (Ontario, Canada)
Allite Mfg. Company (Calif.)
American Engineering Co. (Pa.)
Aro Equipment Corp., The (Ohio)
Arter Grinding Mach. Co. (Mass.)
Barber, F. F. Machinery Company (Ontario, Canada)
Black & Decker Mfg. Co., The (Md.)
Blanchard Machine Co., The (Mass.)
Boice-Crane Company (Ohio)
Bourke & Mabee (Ont., Can.)
Bridgeport Safety Emery Wheel Co., Inc. (Connecticut)
Buckeye Tools Corp. (Ohio)
Champion Blower & Forge Co. (Pa.)
Cincinnati Electrical Tool Co. (Ohio)
Cincinnati Milling Machine Co., The (Ohio)
Cleveland Tool Engineering Co. (Ohio)
Clover Mfg. Co. (Conn.)
Continental Machines, Inc. (Minn.)
Covel-Hanchett Co. (Mich.)
Covel Mfg. Co. (Mich.)
DoAll Co., The (Minn.)
Douglas Machinery Co., Inc. (N.Y.)
Dunmore Company, The (Wis.)
Duro Metal Products Co. (Ill.)
Eagle Grinding Wheel Co. (Ill.)
Electric Heater Co., The (Conn.)
Engineering Laboratories Inc. (N.J.)
Ex-Cell-O Corp. (Mich.)
Fitchburg Grinding Machine Corp. (Massachusetts)
Foredom Electric Co. (N.Y.)
Frisch, Arthur Co. (N.Y.)
Gardner Machine Co. (Wis.)
Gear Grinding Machine Co. (Mich.)
Gray Motor and Tool Co., Inc. (New York)
Grobet File Co. of America (N.Y.)
Hammond Machinery Builders, Inc. (Michigan)
Hanchett Mfg. Co. (Mich.)
Haskins, R. G. Co. (Ill.)
Hisey-Wolf Machine Co. (Ohio)
Hockaday Aircraft Corp. (Calif.)
Holm's Mfg. Co. (Wis.)
Hydraulic Machinery Inc. (Mich.)
Independent Pneumatic Tool Co. (Illinois)
Jordan Industries (Ont., Can.)
McGonegal Mfg. Co. (N.J.)
Mead Specialties Co. (Ill.)
Misener Mfg. Co., Inc. (N.Y.)
Mitts & Merrill (Mich.)
Oliver Machinery Co. (Mich.)
Porter-Cable Machine Co. (N.Y.)
Pratt & Whitney (Conn.)
Precise Product Co. (Wis.)
Rivet Lathe & Grinder, Inc. (Mass.)
Royersford Foundry & Machine Co., Inc. (Pennsylvania)
Size Control Co. (Ill.)
Skilsaw, Inc. (Ill.)
Standard Electrical Tool Co. (Ohio)
Stow Manufacturing Co. (N.Y.)
Taft-Pierce Mfg. Co. (R.I.)
United States Electrical Tool Co. (Ohio)
Van Dorn Electric Tool Co. (Md.)
Walker-Turner Company, Inc. (N.J.)
Walls Sales Corp. (N.Y.)
Wickman, A. C. Ltd. (Ont., Can.)
Woshyna Plastic Mold Co. (Mich.)

Grinding wheel

American Emery Wheel Works (R.I.)
Arclay Plastics Products (Calif.)
Atkins and Company, E. C. (Ind.)
Barber, F. F. Machinery Company (Ontario, Canada)
Bourke & Mabee (Ont., Can.)
Bridgeport Safety Emery Wheel Co., Inc. (Connecticut)
Carborundum Company, The (N.Y.)
Clover Mfg. Co. (Conn.)
DoAll Co., The (Minn.)
Dunmore Company, The (Wis.)
Eagle Grinding Wheel Co. (Ill.)
Electric Heater Co., The (Conn.)
Exactone Tool & Die Co. (Calif.)
Gallmeyer & Livingston Co. (Mich.)
Independent Pneumatic Tool Co. (Illinois)
Jordan Industries (Ont., Can.)
Norton Company (Mass.)
Precise Product Co. (Wis.)
Raybestos-Manhattan, Inc. (N.J.)
Stow Manufacturing Co. (N.Y.)
Wickman, A. C. Ltd. (Ont., Can.)

Heat-sealing

Barber, F. F. Machinery Company (Ontario, Canada)
Paraplastics, Inc. (N.Y.)
Sav-Way Industries (Mich.)
Vulcan Metalcraft Ltd. (Ont., Can.)

[MACHINERY, FORMING] Cont.

Hole Cutters

United Engraving Works, Inc. (New York)

Infra-red heating

Adroit Manufacturing Co. (N.Y.)
Ansonia Clock Company, Inc. (N.Y.)
Burdett Mfg. Co. (Ill.)
Jordan Industries (Ont., Can.)
Leominster Tool Co., Inc. (Mass.)
National Bronze Studios (Calif.)
North American Electric Lamp Co. (Missouri)
Rockwell, W. S. Company (Conn.)
Ross, J. O. Engineering Corp. (N.Y.)
Trumbull Electric Mfg. Co. (Conn.)

Inlaying

Apollo Metal Works (Ill.)

Lapping

Acro Tool & Die Works (Ill.)
Aircraft Tools, Inc. (Calif.)
Cincinnati Milling Machine Co., The (Ohio)
Clover Mfg. Co. (Conn.)
Ex-Cell-O Corp. (Mich.)
Holm's Mfg. Co. (Wis.)
McAleer Manufacturing Co. (Mich.)
Size Control Co. (Ill.)

Lathe

Aaron Machinery Co. (N.Y.)
Aircraft Tools, Inc. (Calif.)
Ajax-Doret Metal Products Limited (Ontario, Canada)
Allite Mfg. Company (Calif.)
Arclay Plastics Products (Calif.)
Atlas Press Company (Mich.)
Barber, F. F. Machinery Company (Ontario, Canada)
Betilite Co., Inc. (N.J.)
Boice-Crane Company (Ohio)
Bourke & Mabee (Ont., Can.)
Duro Metal Products Co. (Ill.)
Electric Heater Co., The (Conn.)
Hockaday Aircraft Corp. (Calif.)
Holm's Manufacturing Co. (Wis.)
Hardinge Brothers, Inc. (N.Y.)
Hjorth Lathe & Tool Co. (Mass.)
Jordan Industries (Ont., Can.)
LeBlond, R. K. Machine Tool Co., The (Illinois)
Oliver Machinery Corp. (Mich.)
Pratt & Whitney (Conn.)
Precise Product Co. (Wis.)
Power King Tool Corp. (Ind.)
Rivet Lathe & Grinder, Inc. (Mass.)
Schauer Machine Company (Ohio)
Size Control Co. (Ill.)
South Bend Lathe Works (Ind.)
Standard Tool Co. (Mass.)
Stricker-Brunhuber Co. (N.Y.)
Sundstrand Machine Tool Co. (Ill.)
Walker-Turner Company, Inc. (N.J.)
Warner & Swasey Co. (Ohio)
Woshyna Plastic Mold Co. (Mich.)

Line Centers

Gelber, Samuel S. Co. (Ill.)
Monarch Machine Tool Co. (O.)

Marking

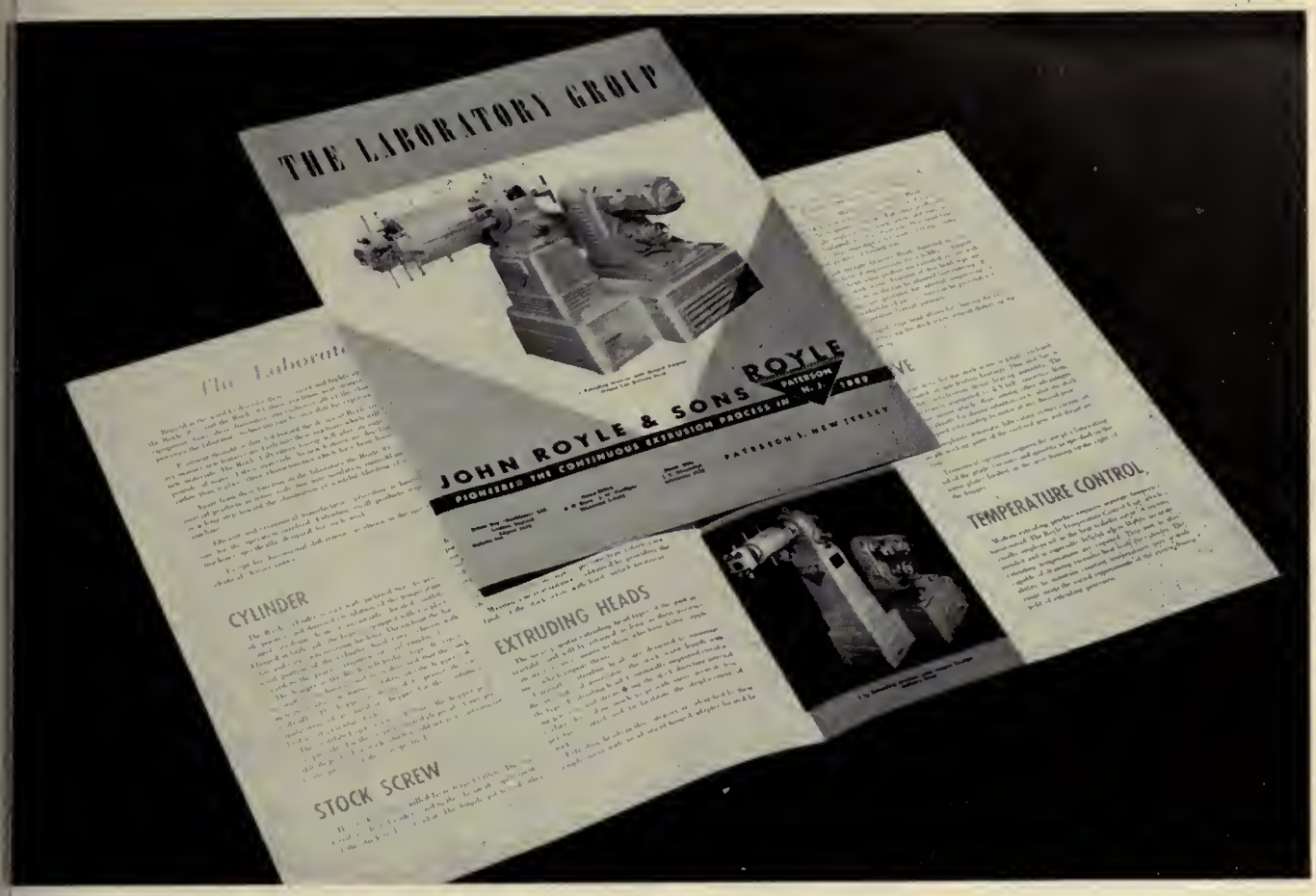
Noble & Westbrook Mfg. Co. (Conn.)
Preis, H. P. Engraving Machine Co. (New Jersey)

Milling

Aaron Machinery Co. (N.Y.)
Aircraft Tools, Inc. (Calif.)
Ajax-Doret Metal Products Limited (Ontario, Canada)
Allite Mfg. Company (Calif.)
Atlas Press Company (Mich.)
Barber, F. F. Machinery Company (Ontario, Canada)
Blank & Buxton Machinery Co. (Michigan)
Bourke & Mabee (Ont., Can.)
Brown & Sharpe Mfg. Co. (R.I.)
Carboloy Company, Inc. (Mich.)
Cincinnati Milling Machine Co., The (Ohio)
Douglas Machinery Co., Inc. (N.Y.)
Ekstrom Carlson & Co. (Ill.)
Electric Heater Co., The (Conn.)
Fray Machine Tool Co. (Calif.)
Frew Machine Company (Pa.)
Gorton, George Machine Co. (Wis.)
Genesee Tool Co. (Mich.)
Hardinge Brothers, Inc. (N.Y.)
Holm's Manufacturing Co. (Wis.)
Invincible Tool Co. (Penna.)
Jordan Industries (Ont., Can.)
Kearney & Trecker Corp. (Wis.)
Kent-Owens Machine Co. (Ohio)
Laboratory Specialties, Inc. (Ind.)
Morse Twist Drill & Machine Co. (Massachusetts)
Pond Engineering Co. (Mass.)
Precise Product Co. (Wis.)
Size Control Co. (Ill.)
Sundstrand Machine Tool Co. (Ill.)
Tungsten Carbide Tool Co. (Mich.)
Woshyna Plastic Mold Co. (Mich.)

Notching

Wales-strippit Corp. (N.Y.)



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[MACHINERY, FORMING] Cont.

Pantograph
Acme Marking Equipment Co. (Michigan)
Acromark Company, The (N.J.)
Adams Company, S. G. (Mo.)
Ajax-Doret Metal Products Limited (Ontario, Canada)
Gorton, George Machine Co. (Wis.)
Mico Instrument Co. (Mass.)
Moss, Samnel H. Inc. (N.Y.)
Pannier Bros. Stamp Co. (Pa.)
Preis, H. P. Engraving Machine Co. (New Jersey)
Wright, Greg & Sons (N.Y.)

Pilling Machine for Preforms
Woshyna Plastic Mold Co. (Mich.)

Planer
Allite Mfg. Company (Calif.)
Barber, F. F. Machinery Company (Ontario, Canada)
Boice-Crane Company (Ohio)
Bourke & Mabee (Ont., Can.)
Buss Machine Works (Mich.)
Holm's Manufacturing Co. (Wis.)
Laboratory Specialties, Inc (Ind.)
Oliver Machinery Co. (Mich.)
Walker-Turner Company, Inc. (N.J.)

Pneumatic (abrasive drums)
Ekstrom Carlson & Co. (Ill.)

Polishing
Aircraft Tools, Inc. (Calif.)
Allite Mfg. Company (Calif.)
American Buff Co. (Ill.)
Arclay Plastics Products (Calif)
Aro Equipment Corp., The (Ohio)
Baldor Electric Co. (Mo.)
Barber, F. F. Machinery Company (Ontario, Canada)
Betilite Co., Inc. (N.J.)
Black & Decker Mfg. Co., The (Md.)
Bourke & Mabee (Ont., Can.)
Canadian Hanson & Van Winkle Co. Limited (Ontario, Canada)
Cincinnati Electrical Tool Co. (Ohio)
Codman, F. L. & J. C. Co. (Mass.)
Clover Mfg. Co. (Conn.)
Detroit Surfacing Machine Co. (Mich.)
Divine Brothers Co. (N.Y.)
DoAll Co., The (Minn.)
Frisch, Arthur Co. (N.Y.)
Gardner Machine Co. (Wis.)
Hammond Machinery Builders, Inc. (Michigan)
Hanson-Van Winkle-Munning Co. (New Jersey)
Hisey-Wolf Machine Co. (Ohio)
Holm's Mfg. Co. (Wis.)
Independent Pneumatic Tool Co. (Illinois)
Innis, Speiden & Co. (N.Y.)
Jordan Industries (Ont., Can.)
Lea Manufacturing Co., The (Conn.)
Leiman Bros., Inc. (N.J.)
Leominster Tool Co., Inc. (Mass.)
McAleer Manufacturing Co. (Mich.)
National Bronze Studios (Calif.)
Packer Machine Co., The (Conn.)
Precise Product Co. (Wis.)
Production Machine Co. (Mass.)
Schauer Machine Company (Ohio)
Siebert, Rudolph R. (N.Y.)
Skilsaw, Inc. (Ill.)
Standard Electrical Tool Co. (Ohio)
Sterling Tool Products Co. (Ill.)
Stow Manufacturing Co. (N.Y.)
United Laboratories Co. (N.J.)
United States Electrical Tool Co. (Ohio)
Walker-Turner Company, Inc. (N.J.)
Wickman, A. C. Ltd. (Ont., Can.)

Pressure Vessels
Verson Allsteel Press Co. (Ill.)

Print reproduction
Donner Mfg. Co. (Ohio)

Printing
Acromark Company, The (N.J.)
Adams Company, S. G. (Mo.)
American Name Plate & Mfg. Co. (Illinois)
Ansonia Clock Company, Inc. (N.Y.)
Baldwin Southwark Div. (Pa.)
Baldwin Locomotive Works, The
Griffin, Campbell, Hayes, Walsh, Inc. (New York)
Jordan Industries (Ont., Can.)
Markem Machine Co. (N.H.)
Pannier Bros. Stamp Co. (Pa.)
Pease, C. F. Co., The (Ill.)
Peerless Roll Leaf Co., Inc. (N.J.)

Profiling
Albert, L. & Son (N.J.)
Brush Development Co., The (Ohio)
Cincinnati Milling Machine Co., The (Ohio)
Frew Machine Co., The (Pa.)
Holm's Manufacturing Co. (Wis.)
New Method Steel Stamps, Inc. (Michigan)
Pratt & Whitney (Conn.)
Precise Product Co. (Wis.)
Severance Tool Industries, Inc. (Michigan)
Spiegel Sales Co. (Mich.)
Woshyna Plastic Mold Co. (Mich.)

[MACHINERY, FORMING] Cont.

Punch
Ajax-Doret Metal Products Limited (Ontario, Canada)
Allite Mfg. Company (Calif.)
Ansonia Clock Company, Inc. (N.Y.)
Bawden Machine Co. Ltd., The (Ontario, Canada)
Bourke & Mahee (Ont.,Can.)
Carholoy Company, Inc. (Mich.)
Cedar-West Tool Co., Inc. (N.Y.)
Cleveland Punch & Shear Works Co. (Ohio)
Electric Heater Co., The (Conn.)
Jessop Steel Co. (Pa.)
Jordan Industries (Ont., Can.)
Niagara Machine & Tool Works (New York)
Size Control Co. (Ill.)
V & O Press Co., Inc., The (N.Y.)
Wales-Strippit Corp. (N.Y.)
Wickman, A. C. Ltd. (Ont., Can.)

Reaming
Ace Drill Corp. (Mich.)
Aircraft Tools, Inc. (Calif.)
Allite Mfg. Company (Calif.)
Aro Equipment Corp., The (Ohio)
Bourke & Mabee (Ont., Can.)
Cleveland Twist Drill Co. (Ohio)
Electric Heater Co., The (Conn.)
Greenfield Tap & Die Corp. (Mass.)
Grobet File Co. of America (N.Y.)
Hjorth Lathe & Tool Co. (Mass.)
Holm's Manufacturing Co. (Wis.)
Jessop Steel Co. (Pa.)
McCrosky Tool Corp. (Pa.)
Morse Twist Drill & Machine Co. (Mass.)
Neal & Brinker Co. (N.Y.)
Pratt & Whitney (Conn.)
Rickert-Shafer Co. (Pa.)
Rivet Lathe & Grinder, Inc. (Mass.)
Severance Tool Industries, Inc. (Mich).
Stow Manufacturing Co. (N.Y.)
Wetmore Reamer Co. (Wis.)
Wickman, A. C. Ltd. (Ont., Can.)

Rolling
Baldwin Southwark Division (Pa.)
Birdsboro Steel Foundry & Machine Co. (Pennsylvania)
Electric Heater Co., The (Conn.)
Midvale Co., The (Pa.)
Tungsten Carbide Tool Co. (Mich.)

Rotary cutters
Ford, M. A. Mfg. Co., Inc. (Ia.)

Rotary files
Ferriot Brothers, Inc. (Ohio)
Ford, M. A. Mfg. Co., Inc. (Ia.)

Router
Aircraft Tools, Inc. (Calif.)
Allite Mfg. Company (Calif.)
Arclay Plastics Products (Calif.)
Carter, R. L. Div., The Stanley Works (Connecticut)
Cleveland Twist Drill Co. (Ohio)
Duro Metal Products Co. (Ill.)
Ekstrom Carlson & Co. (Ill.)
Gorton, George Machine Co. (Wis.)
Jessop Steel Co. (Pa.)
National Bronze Studios (Calif.)
Neal & Brinker Co. (N.Y.)
New Method Steel Stamps, Inc. (Michigan)
Onsrud Machine Works, Inc. (Ill.)
Pannier Bros. Stamp Co. (Pa.)
Porter, C. O. Machinery Co. (Mich.)
Precise Product Co. (Wis.)
Severance Tool Industries, Inc. (Michigan)
Stanley Electric Tools (Conn.)
Stricker-Brunhuber Co. (N.Y.)
Wickman, A. C. Ltd. (Ont., Can.)
Wright, Greg G. & Sons (N.Y.)

Sandblasting
Ansonia Clock Company, Inc. (N.Y.)
Barber, F. F. Machinery Company (Ontario, Canada)
Electric Heater Co., The (Conn.)
Leiman Bros., Inc. (N.J.)
National Bronze Studios (Calif.)
Paasche Airhrush Co. (Ill.)
Panghorn Corporation (Md.)
Sly, W. W. Mfg. Co., The (Ohio)
Wickman, A. C. Ltd. (Ont., Can.)

Sanding
Aircraft Tools, Inc. (Calif.)
Albert L. & Son (N.J.)
Allite Mfg. Company (Calif.)
Arclay Plastics Products (Calif.)
Armour Sandpaper Works (Ill.)
Aro Equipment Corp., The (Ohio)
Beech Manufacturing Company (Pa.)
Betilite Co., Inc. (N.J.)
Binghamton Flexible Shaft Div., Swartz & White Mfg. Co. (N.Y.)
Black & Decker Mfg. Co., The (Md.)
Boice-Crane Company (Ohio)
Buckeye Tools Corp. (Ohio)
Clarke's Saw & Machine Works (New Jersey)
Clover Mfg. Co. (Conn.)
Crescent Machine Co. (Ohio)
Duro Metal Products Co. (Ill.)
Ekstrom Carlson & Co. (Ill.)

[MACHINERY, FORMING] Cont.

Gray Motor and Tool Co., Inc. (New York)
Holm's Manufacturing Co. (Wis.)
Mattison Machine Works (Ill.)
Mead Specialties Co. (Ill.)
National Bronze Studios (Calif.)
Neal & Brinker Company (N.Y.)
Oliver Machinery Company (Mich.)
Porter-Cable Machine Co. (N.Y.)
Production Machine Co. (Mass.)
Size Control Co. (Ill.)
Skilsaw, Inc. (Ill.)
Smith, H. B. Machine Co. (N.J.)
Sterling Tool Products Co. (Ill.)
Stow Manufacturing Co. (N.Y.)
Sunstrand Machine Tool Co. (Ill.)
Walker-Turner Co., Inc. (N.J.)
Walls Sales Corp. (N.Y.)

Saws
Aircraft Tools, Inc. (Calif.)
Allite Mfg. Company (Calif.)
American Saw Mill Machinery Co. (New Jersey)
Arclay Plastics Products (Calif.)
Atkins and Company, E. C. (Ind.)
Atlas Press Company (Mich.)
Barnes, W. O. Co. (Mich.)
Beech Manufacturing Co. (Pa.)
Betilite Co., Inc. (N.J.)
Black & Decker Mfg. Co., The (Md.)
Boice-Crane Company (Ohio)
Bourke & Mahee (Ont., Can.)
Chicago Precision Equipment Co. (Illinois)
Clarke's Saw & Machine Works (New Jersey)
Continental Machines, Inc. (Minn.)
Covel Mfg. Co. (Mich.)
Crescent Machine Co. (Ohio)
Disston, Henry & Sons, Inc. (Pa.)
Duro Metal Products Co. (Ill.)
DoAll Co., The (Minn.)
Electric Heater Co., The (Conn.)
Frew Machine Co., The (Pa.)
Gay-Lee Company (Mich.)
Gray Motor and Tool Co., Inc. (New York)
Genesee Tool Co. (Mich.)
Hockaday Aircraft Corp. (Calif.)
Holm's Manufacturing Co. (Wis.)
Independent Pneumatic Tool Co. (Illinois)
Jordan Industries (Ont., Can.)
Kett Tool Co., The (Ohio)
Leominster Tool Co., Inc. (Mass.)
Mall Tool Company (Ill.)
Misener Mfg. Co., Inc. (N.Y.)
Morse Twist Drill & Machine Co. (Massachusetts)
National Bronze Studios (Calif.)
Neal & Brinker Company (N.Y.)
Oliver Instrument Company (Mich.)
Oliver Machinery Company (Mich.)
Peerless Machine Company (Wis.)
Porter-Cahle Machine Co. (N.Y.)
Power King Tool Corp. (Ind.)
Simonds Saw and Steel Co. (Mass.)
Skilsaw, Inc. (Ill.)
Spiegel Sales Co. (Mich.)
Standard Tool Co. (Mass.)
Van Dorn Electric Tool Co. (Md.)
Walker-Turner Co., Inc. (N.J.)

Scraping
Allite Mfg. Company (Calif.)
Anderson Bros. Mfg. Co. (Ill.)
Jordan Industries (Ont., Can.)

Setting-up form
Ahle Machine and Tool Works (N.Y.)

Shaping
Aaron Machinery Co. (N.Y.)
Arclay Plastics Products (Calif.)
Atlas Press Company (Mich.)
Beech Manufacturing Company (Pa.)
Betilite Co., Inc. (N.J.)
Boice-Crane Company (Ohio)
Cincinnati Shaper Co., The (Ohio)
Electric Heater Co., The (Conn.)
Frisch, Arthur Co. (N.Y.)
Genesee Tool Co. (Mich.)
Jordan Industries (Ont., Can.)
Michigan Tool Co. (Mich.)
National Bronze Studios (Calif.)
Oliver Machinery Co. (Mich.)
Onsrud Machine Works, Inc. (Ill.)
Precise Products Co. (Wis.)
Stanley Electric Tools (Conn.)
Woshyna Plastic Mold Co. (Mich.)

Shearing
Allite Mfg. Company (Calif.)
Cincinnati Shaper Co., The (Ohio)
Cleveland Punch & Shear Works Co. (Ohio)
Electric Heater Co., The (Conn.)
Famco Machine Company (Wis.)
Jordan Industries (Ont., Can.)
Niagara Machine & Tool Works (New York)
O'Neil-Irwin Mfg. Co. (Minn.)
Peck, Stow & Wilcox Co. (Conn.)
Simonds Saw and Steel Co. (Mass.)
Spadone Machine Co. (N.Y.)

Silk screen reproduction
Adams Company, S. G. (Mo.)
American Name Plate & Mfg. Co. (Illinois)
Ansonia Clock Company, Inc. (N.Y.)
Arclay Plastics Products (Calif.)

[MACHINERY, FORMING] Cont.

Display Sign Center, Inc. (N.Y.)
Industrial Arts, Inc. (Ill.)
Jordan Industries (Ont., Can.)
Power King Tool Corp. ((Ind.)

Slotter
Douglas Machinery Co., Inc. (N.Y.)
Precise Product Co. (Wis.)
Woshyna Plastic Mold Co. (Mich.)

Spindle
Onsrud Machine Works, Inc. (Ill.)

Stamping
Ackerman-Gould Co. (N.Y.)
Acme Marking Equipment Co. (Michigan)
Acromark Company, The (N.J.)
Adams Co., S. G. (Mo.)
Aircraft Tools, Inc. (Calif.)
Ajax-Doret Metal Products Limited (Ontario, Canada)
Allite Mfg. Company (Calif.)
Ansonia Clock Company, Inc. (N.Y.)
Cedar-West Tool Co., Inc. (N.Y.)
Cincinnati Shaper Co., The (Ohio)
Cleveland Punch & Shear Works Co. (Ohio)
Colonial Broach Co. (Mich.)
Defiance Machine & Tool Co., Inc. (Missouri)
Electric Heater Co., The (Conn.)
Frisch, Arthur Co. (N.Y.)
Gottscho, Adolph, Inc. (N.Y.)
Griffin, Campbell, Hayes, Walsh, Inc. (New York)
Holm's Manufacturing Co. (Wis.)
Industrial Products Suppliers (N.Y.)
Markem Machine Co. (N.H.)
Moss, Samuel H., Inc. (N.Y.)
Pannier Bros. Stamp Co. (Pa.)
Parker Stamp Works, Inc. (Conn.)
Peerless Roll Leaf Co., Inc. (N.J.)
Reimuller Bros. Co. (Ill.)
Size Control Co. (Ill.)
Sossner Steel Stamps (N.Y.)
Wright, Greg G. & Sons (N.Y.)

Stamping leaf for decorating
Griffin, Camphell, Hayes, Walsh, Inc. (New York)

Static balancers
Gelher, Samuel S. Co. (Ill.)

Stencil machine
Acme Marking Equipment Co. (Michigan)
Aircraft Tools, Inc. (Calif.)
Holm's Manufacturing Co. (Wis.)
Moss, Samuel H., Inc. (N.Y.)
Pannier Bros. Stamp Co. (Pa.)
Wright, Greg G. & Sons (N.Y.)

Stencil sandblast machining
Moss, Samuel H., Inc. (N.Y.)
Leiman Bros., Inc. (N.J.)

Swedging
Jordan Industries (Ont., Can.)

Tapping
Aircraft Screw Products Company, Inc. (New York)
Ajax-Doret Metal Products Limited (Ontario, Canada)
Allite Mfg. Company (Calif.)
American Screw Co. (R.I.)
Arclay Plastics Products (Calif.)
Atlas Press Company (Mich.)
Barber, F. F. Machinery Company (Ontario, Canada)
Black & Decker Mfg. Co., The (Md.)
Bourke & Mabee (Ont., Can.)
Cedar-West Tool Co., Inc. (N.Y.)
Detroit Tap & Tool Co. (Mich.)
Douglas Machinery Co., Inc. (N.Y.)
Gelber, Samuel S. Co. (Ill.)
Greenfield Tap & Die Corp. (Mass.)
Jordan Industries (Ont., Can.)
Murchey Machine & Tool Co. (Mich.)
Procunier Safety Chuck Co. (Ill.)
Size Control Co. (Ill.)
Sossner Steel Stamps (N.Y.)
Van Dorn Electric Tool Co. (Md.)
Wickman, A. C. Ltd. (Ont., Can.)
Winter Brothers Co. (Mass.)

Thread grinding
Bourke & Mabee (Ont., Can.)
Dunmore Company, The (Wis.)
Jordan Industries (Ont., Can.)
Karelsen, E., Inc. (N.Y.)
Size Control Co. (Ill.)
Stow Manufacturing Co. (N.Y.)
Wickman, A. C. Ltd. (Ont., Can.)

Threading
Allite Mfg. Company (Calif.)
Barber, F. F. Machinery Company (Ontario, Canada)
Bourke & Mabee (Ont., Can.)
Cedar-West Tool Co., Inc. (N.Y.)
Eastern Machine Screw Corp. (Connecticut)
Electric Heater Co., The (Conn.)
Greenfield Tap & Die Corp. (Mass.)
Jordan Industries (Ont., Can.)
Murchey Machine & Tool Co. (Michigan)
National Bronze Studios (Calif.)
Procunier Safety Chuck Co. (Ill.)
Rivet Lathe & Grinder Inc. (Mass.)
Size Control Co. (Ill.)
V & O Press Co., Inc., The (N.Y.)
Wickman, A. C. Ltd. (Ont., Can.)

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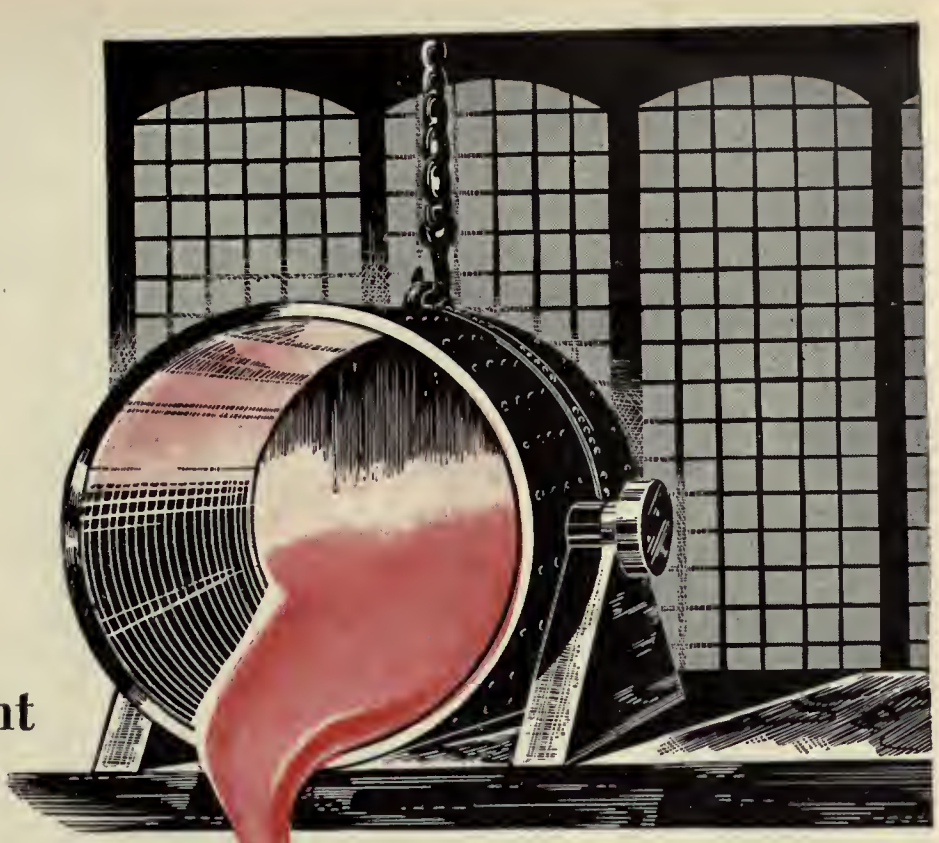

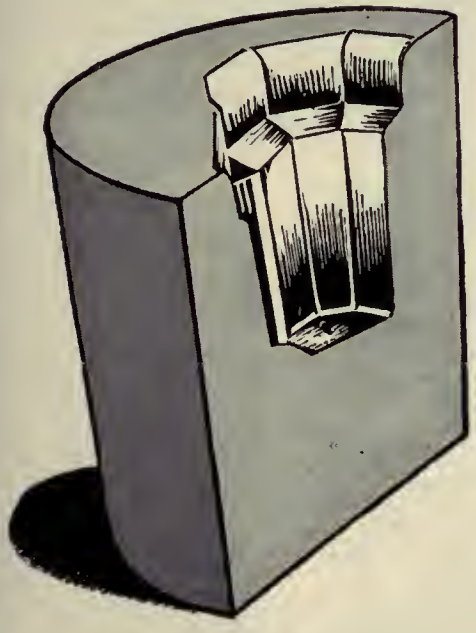

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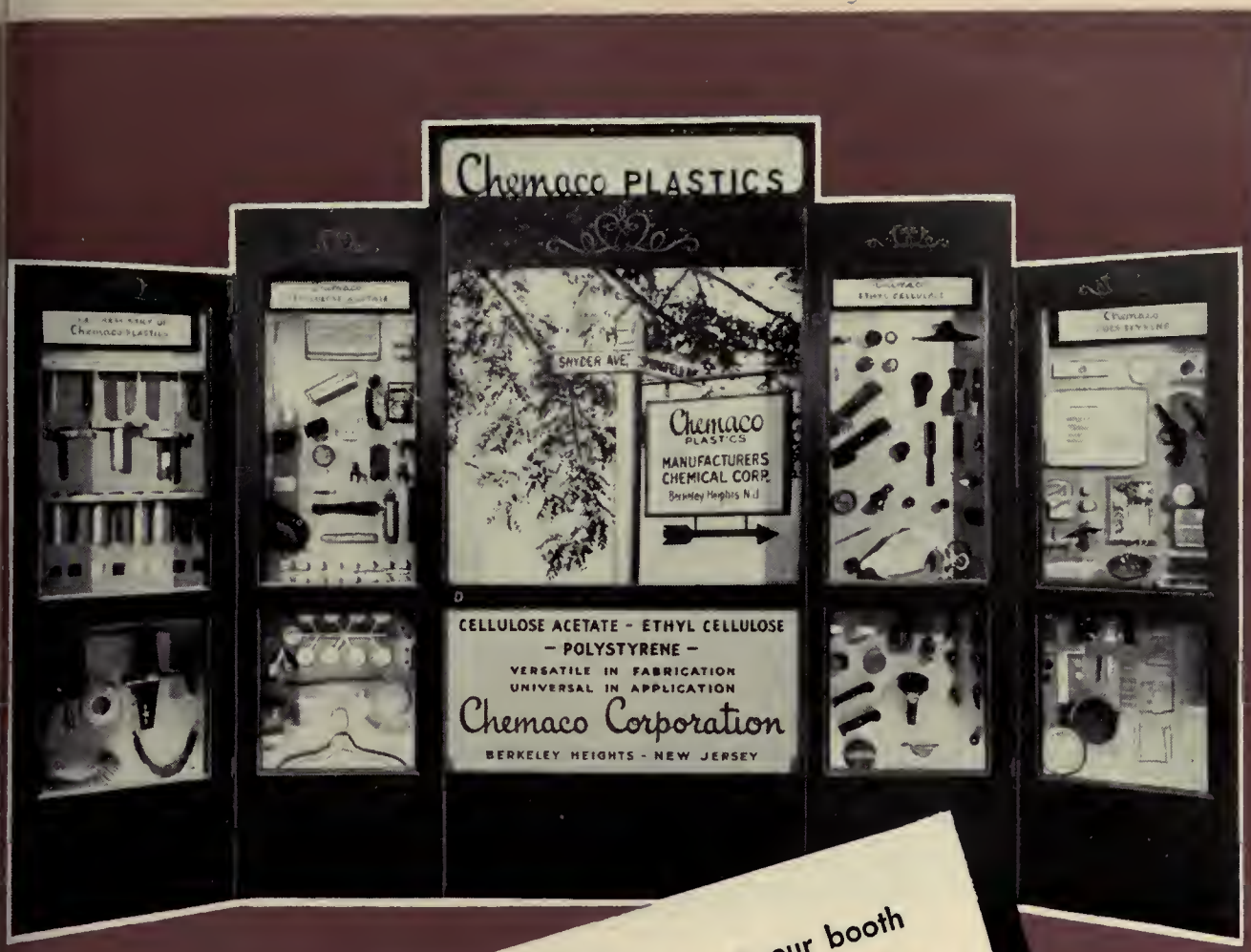

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American Rotary Tools Company, Inc. (New York)
Bridgeport Safety Emery Wheel Co., Inc. (Connecticut)
Carborundum Company, The (N.Y.)
Clover Mfg. Co. (Conn.)
DoAll Co., The (Minn.)
Douglas Machinery Co., Inc. (N.Y.)
Dunmore Company, The (Wis.)
Eagle Grinding Wheel Co. (Ill.)
Electric Heater Co., The (Conn.)
Exactone Tool & Die Co. (Calif.)
Formax Mfg. Co. (Mich.)
Norton Company (Massachusetts)
Severance Tool Industries, Inc. (Michigan)
Size Control Company (Illinois)
Wickman, A. C., Ltd. (Ont., Can.)

Hobbing

Arrowsmith Tool & Die Co. (Calif.)
Baldwin Southwark Division (Pa.) Baldwin Locomotive Works, The
Bawden Machine Co., Ltd., The (Ontario, Canada)
Birdsboro Steel Foundry & Machine Co. (Pennsylvania)
Doerfler, L. Mfg. Co., Inc. (N.J.)
Dorr Patterson Engr. Co. (Mich.)
Freitag, R. H. Mfg. Co., The (Ohio)
French Oil Mill Machinery Co. (O.)
Harvey Machine Co., Inc. (Calif.)
Henry & Wright Mfg. Co., (Conn.)
Mechanical Mold & Machine Co. (O.)
Michigan Tool Co. (Mich.)
Modern Tool & Die Co., Inc. (Mass.)
Parker Stamp Works, Inc. (Conn.)
Rickert-Shafer Co. (Pennsylvania)
Rodgers Hydraulic, Inc. (Minnesota)
Royal Tool Co., Inc., The (Conn.)
Schoder & Lombard Stamp & Die Co. (New York)
Sossner Steel Stamps (New York)
Special Tool & Machine Co. (Mass.)
Standard Tool Co. (Massachusetts)
Stricker-Brunhuber Co. (New York)
Summit Roberts Tool Co. (Ohio)
Trigon Company, The (New York)
Wentworth Machine Co., Ltd. (Ontario, Canada)

Hob Cutters

Priority Die Sinking Co. (Ont., Can.)

Jig borer

Ajax-Doret Metal Products Limited (Ontario, Canada)
Arrowsmith Tool & Die Co. (Calif.)
Barber, F. F. Machinery Company (Ontario, Canada)
Bourke & Mabee (Ont., Can.)
Diecraft (Md.)
Electric Heater Co., The (Conn.)
Freitag, R. H. Mfg. Co., The (Ohio)
Gorton, George Machine Co. (Wis.)
Harvey Machine Co., Inc. (Calif.)
Holm's Manufacturing Co. (Wis.)
Kearney & Trecker Corp. (Wis.)
Mechanical Mold & Machine Co. (O.)
Moore Special Tool Co., Inc. (Conn.)
Pratt & Whitney (Connecticut)
Steinen, Wm. Mfg. Co. (New Jersey)
Special Tool & Machine Co. (Mass.)
Standard Tool Co. (Massachusetts)
Summit Roberts Tool Co. (Ohio)
Wentworth Machine Co., Ltd. (Ontario, Canada)
Wickman, A. C., Ltd. (Ont., Can.)

Lapping

Acme-Danneman Co., Inc. (N.Y.)
Acro Tool & Die Works (Illinois)
Arrowsmith Tool & Die Co. (Calif.
Burns, E. Reed Mfg. Corp. (N.Y.)
Ex-Cell-O Corporation (Michigan)
Holm's Manufacturing Co. (Wis.)
Size Control Company (Illinois)
Summit Robert Tool Co. (Ohio)
Walker-Turner Company, (N.J.)
Wentworth Machine Co., Ltd. (Ontario, Canada)
Wickman, A. C., Ltd. (Ont., Can.)

Lathe

Aaron Machinery Co. (New York)
Acme-Danneman Co., Inc. (N.Y.)
Aircraft Tools, Inc. (California)
Ajax-Doret Metal Products Limitec (Ontario, Canada)
Arrowsmith Tool & Dies Co. (Calif.)
Atlas Press Company (Mich.)
Barber, R. F. Machinery Company (Ontario, Canada)
Boice-Crane Company (Ohio)
Bourke & Mabee (Ont., Can.)
Crescent Machine Co., The (Ohio)
Diecraft (Md.)
Electric Heater Co., The (Conn.)
Freitag, R. H. Mfg. Co., The (Ohio)
Hardinge Brothers, Inc. (N.Y.)
Harvey Machine Co.. Inc. (Calif.)
Hjorth Lathe & Tool Co. (Mass.)
Hockaday Aircraft Corp. (Calif.)
Holm's Manufacturing Co. (Wis.)
Laboratory Specialties, Inc. (Indiana
LeBlond, R. K. Machine Tool Co. The (Illinois)
Mechanical Mold & Machine Co. (O.)
Monarch Machine Tool Co. (Ohio)
Pioneer Mold Company (Ohio)
Pratt & Whitney (Connecticut)
Rivet Lathe & Grinder, Inc. (Mass.)
Royal Tool Co., Inc., The (Conn.)
Size Control Company (Illinois)
Special Tool & Machine Co. (Mass.)
Standard Tool Co. (Massachusetts)
Steinen, Wm. Mfg. Co. (New Jersey)
Stricker-Brunhuber Co. (New York)
Summit Roberts Tool Co. (Ohio)
Walker-Turner Company, Inc. (N.J.)
Wentworth Machine Co., Ltd. (Ontario, Canada)

Marking

Acme Marking Equipment Co. (Michigan)
Acromark Company, The (N.J.)
Defiance Machine & Tool Co., Inc. (Missouri)
Diecraft (Md.)
Hjorth Lathe & Tool Co. (Mass.)
Ideal Commutator Dresser Co. (Ill.)
Moss, Samuel H., Inc. (N.Y.)
New Method Steel Stamps, Inc. (Michigan)
Parker Stamp Works, Inc. (Conn.)
Summit Roberts Tool Co. (Ohio)

Melting furnace equipment

Eclipse Fuel Engineering Co. (Ill.)
Knapp, James H. Co. (Calif.)
Surface Combustion (Ohio)
Rockwell, W. S. Company (Conn.)
Univertical Machine Co. (Michigan)
Wentworth Machine Co., Ltd. (Ontario, Canada)

Milling

Aaron Machinery Co. (New York)
Acme-Danneman Co., Inc. (N.Y.)
Ajax-Doret Metal Products Limited (Ontario, Canada)
Arrowsmith Tool & Die Co. (Calif.)
Atlas Press Company (Mich.)
Blank & Buxton Machinery Co. (Michigan)
Bourke & Mabee (Ont., Can.)
Diecraft (Md.)
Douglas Machinery Co., Inc. (N.Y.)
Ekstrom Carlson & Co. (Ill.)
Electric Heater Co., The (Conn.)
Fray Machine Tool Co. (California)
Frew Machine Co. (Pennsylvania)
Gorton, George Machine Co. (Wis.)
Hardinge Brothers, Inc. (N.Y.)
Holm's Manufacturing Co. (Wis.)
Invincible Tool Co. (Penna.)
Kearney & Trecker Corp. (Wis.)
Morse Twist Drill & Machine Co. (Massachusetts)
Pioneer Mold Company (Ohio)
Pond Engineering Company (Mass.)
Royal Tool Co., Inc., The (Conn.)
Size Control Company (Illinois)
Special Tool & Machine Co. (Mass.)
Standard Tool Co. (Massachusetts)
Stricker-Brunhuber Co. (New York)
Univertical Machine Co. (Michigan)
Wentworth Machine Co., Ltd. (Ontario, Canada)

Notching

Wales-Strippit Corp. (New York)

Pantograph engraving

Acme Marking Equipment Co. (Michigan)
Acromark Company, The (N.J.)
Diecraft (Md.)
Freitag, R. H. Mfg. Co., The (Ohio)
Gorton, George Machine Co. (Wis.)
Impression Die Co. (Mich.)

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Auburn's staff of trained engineers are molded plasties specialists. Their knowledge and research work for you from design, through mold-making, production, and inspection.

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Moss, Samuel H., Inc. (N.Y.)
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Sossner Steel Stamps (New York)
Standard Tool Co. (Massachusetts)
Stricker-Brunhuber Co. (New York)
United Cinephone Corp. (Conn.)
Wentworth Machine Co., Ltd. (Ontario, Canada)
Wright, Greg G. & Sons (New York)

Pantograph milling

Acme Marking Equipment Co. (Michigan)
Arrowsmith Tool & Die Co. (Calif.)
Diecraft (Md.)
Freitag, R. H. Mfg. Co., The (Ohio)
Gorton, George Machine Co. (Wis.)
Holm's Manufacturing Co. (Wis.)
Moss, Samuel H., Inc. (N.Y.)
New Method Steel Stamps, Inc. (Michigan)
Parker Stamp Works, Inc. (Conn.)
Standard Tool Co. (Massachusetts)
Stricker-Brunhuber Co. (New York)
Wentworth Machine Co., Ltd. (Ontario, Canada)
Wright, Greg G. & Sons (New York)

Planer

Arrowsmith Tool & Die Co. (Calif.)
Boice-Crane Company (Ohio)
Bourke & Mabee (Ont., Can.)
Buss Machine Works (Michigan)
Crescent Machine Co., The (Ohio)
Diecraft (Md.)
Electric Heater Co., The (Conn.)
Freitag, R. H. Mfg. Co., The (Ohio)
Harvey Machine Co., Inc. (Calif.)
Holm's Manufacturing Co. (Wis.)
Laboratory Specialties, Inc. (Ind.)
Mechanical Mold & Machine Co. (O.)
Pioneer Mold Company (Ohio)
Rockford Machine Tool Co. (Illinois)
Special Tool & Machine Co. (Mass.)
Walker-Turner Co., Inc. (N.J.)

Polishing

American Buff Company (Illinois)
Aro Equipment Corp., The (Ohio)
Arrowsmith Tool & Die Co. (Calif.)
Barber, F. F. Machinery Company (Ontario, Canada)
Beech Manufacturing Co. (Pa.)
Bourke & Mabee (Ont., Can.)
Cincinnati Electrical Tool Co. (O.)
Clover Mfg. Co. (Conn.)
Divine Brothers Co., Inc. (N.Y.)
DoAll Co., The (Minn.)
Ferriot Brothers, Inc. (Ohio)
Formax Mfg. Co. (Mich.)
Freitag, R. H. Mfg. Co., The (Ohio)
Hanson-Van Winkle-Munning Co. (New Jersey)
Hisey-Wolf Machine Co., The (Ohio)
Holm's Manufacturing Co. (Wis.)
Lea Manufacturing Co., The (Conn.)
Independent Pneumatic Tool Co. (Illinois)
McAleer Manufacturing Co. (Mich.)
Siebert, Rudolph R. (New York)
Special Tool & Machine Co. (Mass.)
Standard Electrical Tool Co. (Ohio)
Stow Manufacturing Co. (New York)
Summit Roberts Tool Co. (Ohio)
Wentworth Machine Co., Ltd. (Ontario, Canada)
Wickman, A. C., Ltd. (Ont., Can.)

Polishing lathes

Hanson-Van Winkle-Munning Co. (New Jersey)

Pressure Switches

Progressive Welder Co. (Michigan)

Profiling

Bourke & Mabee (Ont., Can.)
Brush Development Co., The (Ohio)
Diecraft (Md.)
Freitag, R. H. Mfg. Co., The (Ohio)
Frew Machine Co., The (Pa.)
Gorton, George Machine Co. (Wis.)
Harvey Machine Co., Inc. (Calif.)
Holm's Manufacturing Co. (Wis.)
Mechanical Mold & Machine Co. (O.)
New Method Steel Stamps, Inc. (Michigan)
Onsrud Machine Works, Inc. (Ill.)
Pratt & Whitney (Connecticut)
Severance Tool Industries, Inc. (Michigan)
Special Tool & Machine Co. (Mass.)
Spiegel Sales Company (Michigan)
Standard Tool Co. (Massachusetts)
Summit Roberts Tool Co. (Ohio)
Wentworth Machine Co., Ltd. (Ontario, Canada)

Punch press

Ajax-Doret Metal Products Limited (Ontario, Canada)
Barber, F. F. Machinery Company (Ontario, Canada)
Bawden Machine Co., Ltd., The (Ontario, Canada)
Bourke & Mabee (Ont., Can.)
Diecraft (Md.)
Electric Heater Co., The (Conn.)

Harvey Machine Co., Inc. (Calif.)
Holm's Manufacturing Co. (Wis.)
Moss, Samuel H., Inc. (N.Y.)
Nooter, John Boiler Work Co. (Mo.)
Size Control Company (Illinois)
Special Tool & Machine Co. (Mass.)
Stricker-Brunhuber Co. (New York)
Summit Roberts Tool Co. (Ohio)
Univertical Machine Co. (Michigan)
V & O Press Co., Inc., The (N.Y.)

Reamer

Acro Tool & Die Works (Illinois)
Aircraft Tools, Inc. (California)
Bourke & Mabee (Ont., Can.)
Chicago-Latrobe Twist Drill Works (Illinois)
Cleveland Twist Drill Co., The (O.)
Electric Heater Co., The (Conn.)
Genesee Tool Company (Michigan)
Grobet File Co. of America (N.Y.)
Harvey Machine Co., Inc. (Calif.)
Hole Engineering Service (Michigan)
Holm's Manufacturing Co. (Wis.)
Independent Pneumatic Tool Co. (Illinois)
McCrosky Tool Corporation (Pa.)
Morse Twist Drill & Machine Co. (Massachusetts)
Neal & Brinker Co. (New York)
Pratt & Whitney (Connecticut)
Rickert-Shafer Co. (Pennsylvania)
Severance Tool Industries, Inc. (Michigan)
Stow Manufacturing Co. (New York)
Wentworth Machine Co., Ltd. (Ontario, Canada)
Wetmore Reamer Co. (Wisconsin)
Wickman, A. C., Ltd. (Ont., Can.)

Router

Aircraft Tools, Inc. (California)
American Rotary Tools Company, Inc. (N.Y.)
Boice-Crane Company (Ohio)
Bourke & Mabee (Ont., Can.)
Carter, R. L. Division (Conn.) Stanley Works, The
Cleveland Twist Drill Co., The (O.)
Diecraft (Md.)
Duro Metal Products Co. (Illinois)
Harvey Machine Co. (California)
Hjorth Lathe & Tool Co. (Mass.)
Holm's Manufacturing Co. (Wis.)
Ekstrom Carlson & Co. (Ill.)
Freitag, R. H. Mfg. Co., The (Ohio)
Gorton, George Machine Co. (Wis.)
Mechanical Mold & Machine Co. (O.)
New Method Steel Stamps, Inc. (Michigan)
Onsrud Machine Works, Inc. (Ill.)
Neal & Brinker Co. (New York)
Porter, C. O. Machinery Co. (Mich.)
Stanley Electric Tools (Connecticut)
Stricker-Brunhuber Co. (New York)
Wickman, A. C., Ltd. (Ont., Can.)
Wright, Greg G. & Sons (New York)

Router bit

American Rotary Tools Company, Inc. (N.Y.)
Boice-Crane Company (Ohio)
Bourke & Mabee (Ont., Can.)
Ekstrom Carlson & Co. (Ill.)
Gorton, George Machine Co. (Wis.)
Onsrud Machine Works, Inc. (Ill.)
Severance Tool Industries, Inc. (Michigan)
Stanley Electric Tools (Connecticut)
Stricker-Brunhuber Co. (New York)
Wickman, A. C., Ltd. (Ont., Can.)

Sandblasting

Pangborn Corporation (Maryland)

Sanding

Aircraft Tools, Inc. (California)
American Rotary Tools Company, Inc. (N.Y.)
Aro Equipment Corp., The (Ohio)
Beech Manufacturing Company (Pa.)
Binghamton Flexible Shaft Div. (N.Y.) Swartz & White Mfg. Co.
Black & Decker Mfg. Co., The (Md.)
Boice-Crane Company (Ohio)
Buckeye Tools Corp. (Ohio)
Clarke's Saw & Machine Works (New Jersey)
Clover Mfg. Co. (Conn.)
Crescent Machine Co., The (Ohio)
Diecraft (Md.)
Duro Metal Products Co. (Illinois)
Ekstrom Carlson & Co. (Ill.)
Gray Motor & Tool Co., Inc. (N.Y.)
Hockaday Aircraft Corp. (California)
Holm's Manufacturing Co. (Wis.)
Independent Pneumatic Tool Co. (Illinois)
Mattison Machine Co. (Illinois)
Mead Specialties Co. (Ill.)
Merit Products, Inc. (Calif.)
Neal & Brinker Co. (New York)
Porter-Cable Machine Co. (N.Y.)
Size Control Company (Illinois)
Skilsaw, Inc. (Illinois)
Smith, H. B. Machine Co. (N.J.)
Sterling Tool Products Co. (Ill.)
Stow Manufacturing Co. (New York)
Walker-Turner Co., Inc. (N.J.)
Walls Sales Corp. (New York)

Saw

Aircraft Tools, Inc. (California)
American Saw Mill Machinery Co. (New Jersey)
Atlas Press Company (Mich.)
Barnes, W. O. Co. (Mich.)
Beech Manufacturing Company (Pa.)
Black & Decker Mfg. Co., The (Md.)
Boice-Crane Company (Ohio)
Chicago Precision Equipment Co. (Illinois)
Clarke's Saw & Machine Works (New Jersey)
Continental Machines, Inc. (Minn.)
Covel Manufacturing Co. (Michigan)
Crescent Machine Company (Ohio)
Diecraft (Md.)
Disston, Henry & Sons, Inc. (Pa.)
DoAll Co., The (Minn.)
Duro Metal Products Co. (Illinois)
Electric Heater Co., The (Conn.)
Frew Machine Co., The (Pa.)
Genesee Tool Company (Michigan)
Gray Motor & Tool Co., Inc. (N.Y.)
Harvey Machine Co., Inc. (Calif.)
Hockaday Aircraft Corp. (Calif.)
Holm's Manufacturing Co. (Wis.)
Independent Pneumatic Tool Co. (Illinois)
Laboratory Specialties, Inc. (Ind.)
Machine Tool Division, Kalamazoo Tank & Silo Co. (Michigan)
Mall Tool Company (Ill.)
Misener Mfg. Co., Inc. (N.Y.)
Morse Twist Drill & Machine Co. (Massachusetts)
Neal & Brinker Co. (New York)
Peerless Machine Co. (Wisconsin)
Pioneer Mold Company (Ohio)
Porter-Cable Machine Co. (N.Y.)
Simonds Saw and Steel Co. (Mass.)
Skilsaw, Inc. (Illinois)
Spiegel Sales Co. (Michigan)
Summit Roberts Tool Co. (Ohio)
Velepec, Fred M., Co. (New York)
Walker-Turner Co., Inc. (N.J.)
Wentworth Machine Co., Ltd. (Ontario, Canada)

Shaping

Aaron Machinery Co. (New York)
Acme-Danneman Co., Inc. (N.Y.)
Aircraft Tools, Inc. (California)
Arrowsmith Tool & Die Co. (Calif.)
Atlas Press Company (Mich.)
Beech Manufacturing Company (Pa.)
Boice-Crane Company (Ohio)
Bridgeport Safety Emery Wheel Co., Inc. (Connecticut)
Bourke & Mabee (Ont., Can.)
Carter, R. L. Division (Conn.) Stanley Works, The
Cincinnati Shaper Co., The (Ohio)
Diecraft (Md.)
Harvey Machine Co., Inc. (Calif.)
Holm's Manufacturing Co. (Wis.)
Mechanical Mold & Machine Co. (O.)
Onsrud Machine Works, Inc. (Ill.)
Pratt & Whitney (Connecticut)
Pioneer Mold Company (Ohio)
Reimuller Bros. Co. (Illinois)
Rockford Machine Tool Co. (Ill.)
Smith & Mills Co., The (Ohio)
Special Tool & Machine Co. (Mass.)
Standard Tool Co. (Massachusetts)
Stanley Electric Tools (Connecticut)
Stricker-Brunhuber Co. (New York)
Summit Roberts Tool Co. (Ohio)
Wentworth Machine Co., Ltd. (Ontario, Canada)

Shearing

Black & Decker Mfg. Co., The (Md.)
Bourke & Mabee (Ont., Can.)
Cincinnati Shaper Co., The (Ohio)
Harvey Machine Co., Inc. (Calif.)
Skilsaw, Inc. (Illinois)

Slotted Discs

Field Abrasive Specialty Mfg. Co. (Ohio)

Slotter

Arrowsmith Tool & Die Co. (Calif.)
Diecraft (Md.)
Douglas Machinery Co., Inc., (N.Y.)
Freitag, R. H. Mfg. Co., The (Ohio)

Spindle

Onsrud Machine Works, Inc. (Ill.)

Spring winders

Hjorth Lathe & Tool Co. (Mass.)

Stamping

Acme Marking Equipment Co. (Michigan)
Acromark Company, The (N.J.)
Ajax-Doret Metal Products Limited (Ontario, Canada)
Barber, F. F. Machinery Company (Ontario, Canada)
Cincinnati Shaper Co., The (Ohio)
Defiance Machine & Tool Co., Inc. (Missouri)
Diecraft (Md.)
Electric Heater Co., The (Conn.)
Moss, Samuel H., Inc. (N.Y.
Parker Stamp Works, Inc. (Conn.)
Size Control Company (Illinois)
Sossner Steel Stamps (New York)
Wright, Greg G. & Sons (New York)

Surface Finish Readings

Size Control Company (Illinois)
Div. American Machine & Gage
Univertical Machine Co. (Michig

Tapping

Acme-Danneman Co., Inc. (N.Y.
Aircraft Screw Products Compa Inc. (New York)
Aircraft Tools., Inc. (California)
Ajax-Doret Metal Products Lim (Ontario, Canada)
Arrowsmith Tool & Die Co. (Calif
Atlas Press Company (Mich.)
Bay State Tap & Die Co. (Mass.
Black & Decker Mfg. Co., The (
Boice-Crane Company (Ohio)
Bourke & Mabee (Ont., Can.)
Douglas Machinery Co., Inc. (N.
Diecraft (Md.)
Electric Heater Co., The (Conn.)
Freitag, R. H. Mfg. Co., The (O
Frew Machine Co., The (Pa.)
Harvey Machine Co., Inc. (Calif.
Haskins, R. G. Co. (Illinois)
Holm's Manufacturing Co. (Wis.
Mechanical Mold & Machine Co. (
Morse Twist Drill & Machine Co. (Massachusetts)
National Automatic Tool Co., Inc. (Indiana)
Pond Engineering Co. (Mass.)
Rickert-Shafer Co. (Pennsylvania
Size Control Company (Illinois)
Sossner Steel Stamps (New York
Steinen, Wm. Mfg. Co. (New Jers
Univertical Machine Co. (Michig
Wickman, A. C., Ltd. (Ont., Can.
Winter Brothers Co. (Massachuse

Thread cutting

Ajax-Doret Metal Products Limi (Ontario, Canada)
Bourke & Mabee (Ont., Can.)
Diecraft (Md.)
Eastern Machine Screw Corp. (Connecticut)
Electric Heater Co., The (Conn.)
Errington Mechanical Lab. (N.Y.
Freitag, R. H. Mfg. Co., The (Oh
Harvey Machine Co., Inc. (Calif
Landis Machine Co. (Pennsylvan
National Acme Co., The (Ohio)
Peerless Machine Co. (Wisconsin)
Pratt & Whitney (Connecticut)
Rivett Lathe & Grinder, Inc. (Mas
Rickert-Shafer Co. (Pennsylvania
Size Control Company (Illinois)
Steinen, Wm. Mfg. Co. (N.J.)
Stow Manufacturing Co. (N.Y.)
Summit Roberts Tool Co. (Ohio)
Wentworth Machine Co., Ltd. (Ontario, Canada)

Thread grinding

Bourke & Mabee (Ont., Can.)
Electric Heater Co., The (Conn.)
Dunmore Company, The (Wis.)
Ex-Cell-O Corporation (Michigan)
Size Control Company (Illinois)
Summit Roberts Tool Co. (Ohio)
Wickman, A. C., Ltd. (Ont., Can.

Thread Rolling

Groov-Pin Corp. (New Jersey)
National Acme Co., The (Ohio)
Size Control Company (Illinois)
V & O Press Co., Inc., The (N.Y.
Waltham Machine Works (Mass.

Tumbling

Bourke & Mabee (Ont., Can.)
Diecraft (Md.)
McAleer Manufacturing Co. (Mich
Minn. Mining & Mfg. Co. (Minn.
Siebert, Rudolph R. (New York)

Welding, atomic

Bourke & Mabee (Ont., Can.)
Electric Heater Co., The (Conn.)
Freitag, R. H. Mfg. Co., The (Ohi
Mechanical Mold & Machine Co. (
Nooter, John Boiler Work Co. (Mo

Welding, electric

Arrowsmith Tool & Die Co. (Calif.)
Bourke & Mabee (Ont., Can.)
Diecraft (Md.)
Electric Heater Co., The (Conn.)
Freitag, R. H. Mfg. Co., The (Ohi
Nooter, John Boiler Work Co. (Mo
Page Steel & Wire Div. (Pa.)
Progressive Welder Co. (Michigan
Standard Tool Co. (Massachusetts)
Summit Roberts Tool Co. (Ohio)
Trindl Products, Ltd. (Illinois)

Welding, oxy-acetylene

Arrowsmith Tool & Die Co. (Calif.
Bastian-Blessing Co. (Illinois)
Diecraft (Md.)
Electric Heater Co., The (Conn.)
Freitag, R. H. Mfg. Co., The (Ohi
Harris Calorific Co. (Ohio)
Linde Air Products Co. (New York
Milburn, Alexander Co., (Marylan
Modern Engineering Co., Inc. (Mo
Nooter, John Boiler Work Co. (Mo
Standard Tool Co. (Massachusetts

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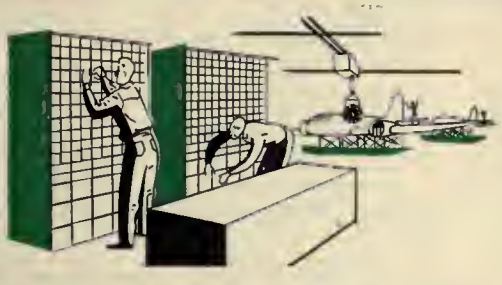

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[MACHINERY] Cont.

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Albert, L. & Son (N.J.)
Aldrich Pump Company, The (Pa.)
Baldwin Southwark Division (Pa.)
Birdsboro Steel Foundry & Machine Company (Pennsylvania)
Dorr Patterson Engr. Co. (Mich.)
Dunning & Boschert Press Co. (N.Y.)
Elmes Engr. Wks. of Amer. Steel Foundries (Ill.)
Farrel-Birmingham Co., Inc. (Conn.)
First Machinery Corp. (New York)
French Oil Mill Machinery Co. (O.)
Grant Research Laboratory (Ill.)
Hydraulic Press Mfg. Co. (Ohio)
Industrial Equipment Co. (N.J.)
Loomis, Evarts G. Co. (New Jersey)
Midvale Company (Pennsylvania)
Oilgear Company, The (Wisconsin)
Seely Instrument Co., Inc. (N.Y.)
Struthers Wells Corp. (Pa.)
Stewart Bolling & Co., Ltd. (Ohio)
Universal Hydraulic Machinery Co. (New York)
Vickers Inc. (Michigan)
Watson Stillman Co. (New Jersey)
Wood, R. D. Co. (Pennsylvania)

Air conditioning
American Air Filter Co., Inc. (Ky.)
American Blower Corp. (Mich.)
Buffalo Forge Company (N.Y.)
Curtis Refrigerator Machine Div. (Missouri).
General Electric Co. (N.Y.)
Kirk & Blum Mfg. Co., The (Ohio)
Tenney Engineering, Inc. (N.J.)
Warner Brothers Co., The (Conn.)

Air filter
American Air Filter Co., Inc. (Ky.)

Air heater
American Blower Corp. (Mich.)
Babcock & Wilcox Co., The (N.Y.)
Despatch Oven Co. (Minn.)
Electric Heater Co., The (Conn.)
General Electric Co. (N.Y.)
Knapp, James H. Co. (Calif.)
Lydon Brothers (N.J.)
Rockwell, W. S. Company (Conn.)
Ross, J. O. Engineering Corp. (N.J.)
Trent, Harold E. (Pennsylvania)

Air velocity measuring instrument
Bristol Company of Canada, Ltd. (Ontario, Canada)
Illinois Testing Laboratories, Inc. (Illinois)

Automatic Operating Fixtures for machine tools
Pond Engineering Co. (Mass.)

Belt Surfacers
Production Machine Co. (Mass.)

Boiler Feedwater Control
Combustion Control Corp. (Mass.)

Carriers
Mack Sales Co. (N.Y.)

Central hydraulic systems
Aldrich Pump Company, The (Pa.)

Conveyor equipment
Adroit Manufacturing Co. (N.Y.)
Baker Industrial Truck Div. (Ohio)
Beebe Bros., Inc. (Washington)
Clark Tructractor (Michigan)
Detrex Corp. (Mich.)
Ekstrom Carlson & Co. (Ill.)
Elwell-Parker Electric Co. (Ohio)
Howe Scale Company, The (Vt.)
Hyster Company (Ore.)
Industrial Oven Engineering Co., The (Ohio)
Ingalls-Miniter Co. (Mass.)
Island Equipment Corp. (N.Y.)
Koch, George, Sons, Inc. (Ind.)
Lydon Brothers (N.J.)
Lyon-Raymond Corp. (N.Y.)
National Ruhber Machinery Co. (O.)
Raybestos-Manhattan, Inc. (N.J.)
Read Machinery Co., Inc. (Pa.)
Reading Chain & Block Corp. (Pa.)
Spencer & Morris (California)
Standard Conveyor Co. (Minnesota)
Towmotor Corporation (Ohio)
Warner Brothers Co., The (Conn.)
West Bend Equipment Corp. (Wis.)
Yale & Towne Mfg. Co., The (Pa.)

Cooling
American Blower Corp. (Mich.)
Buffalo Forge Company (N.Y.)
Devine, J. P. Mfg. Co., Inc. (Ill.)
First Machinery Corp. (New York)
Gray-Mills Co. (Ill.)
Holm's Manufacturing Co. (Wis.)
Improved Paper Machinery Corp. (New Hampshire)
Kirk & Blum Mfg. Co., The (Ohio)
Lydon Brothers (N.J.)
Nooter, John Boiler Works Co. (Mo.)
Tenney Engineering Inc. (N.J.)
Worthington Pump & Machinery Corporation (New Jersey)

Counters
ATC Co., Inc. (Pa.)
Bristol Company of Canada, Ltd. (Ontario, Canada)
Durant Manufacturing Co. (Wis.)
National Acme Co., The (Ohio)

Curing Ovens
Young Brothers Company (Mich.)

Cylinder
Albert, L. & Son (N.J.)
Bellows Company, The (Ohio)
Hanna Engineering Works (Ill.)
Hannifin Mfg. Co. (Ill.)
Industrial Equipment Co. (N.J.)
Logansport Machine Co., Inc. (Ind.)
Miller Motor Co. (Ill.)
Nooter, John Boiler Works Co. (Mo.)
Oilgear Company, The (Wisconsin)
Universal Hydraulic Machinery Co. (New York)

Die casting machines
Kux Machine Co. (Ill.)

Dust collector
Aget-Detroit Company (Mich.)
American Air Filter Co., Inc. (Ky.)
American Blower Corp. (Mich.)
American Foundry Equipment Co. (Indiana)
Barber, F. F. Machinery Company (Ontario, Canada)
Breuer Electric Mfg. Co. (Ill.)
Cedar-West Tool Co., Inc. (N.Y.)
DoAll Co., The (Minn.)
Ideal Commutator Dresser Co. (Ill.)
Kirk & Blum Mfg. Co., The (Ohio)
Koch, George, Sons, Inc. (Ind.)
Pangborn Corporation (Maryland)
Sly, W. W. Mfg. Co., The (Ohio)
Standard Electrical Tool Co. (Ohio)
Torit Manufacturing Co. (Minn.)
Whiting Corporation (Illinois)
Young & Bertke Company (Ohio)

Electric Heating Units
Walton Electric Mfg. Co., (Mo.)

Electric Steem Tables
Standard Tool Co. (Massachusetts)

Electronic components
American Transformer Co. (N.J.)

Escutcheon pin
Industrial Screw Co. (Ill.)

Exhaust equipment
DeVilbiss Co., The (Ohio)

Explosion Safeguard
Wheelco Instruments Co. (Illinois)

Feeds, pneumatic
Bellows Company, The (Ohio)

Feedwater heater
Brosites Machine Co., Inc. (N.Y.)
Edge Moor Iron Works (Del.)

Files
Nicholson File Co. (Rhode Island)

Fire Extinguisher
Pyrene Mfg. Co. (New Jersey)

Flexible shaft grinders
Foredom Electric Co. (N.Y.)

Flow meter
Builders-Providence, Inc. (R.I.)

Forged Steel Fittings
Rockwell, W. S. Company (Conn.)
Torit Manufacturing Co. (Minn.)
Warner Brothers Co., The (Conn.)
Young & Bertke Co. (Ohio)
Watson Stillman Co. (New Jersey)

Fume remover
American Blower Corp. (Mich.)
Kirk & Blum Mfg. Co., The (Ohio)

Gasket
Industrial Products Suppliers (N.Y.)

Gears
Farrel-Birmingham Co., Inc. (Conn.)
Foote Bros. Gear & Machine Corp. (Illinois)

Generetor
Aircraft Tools, Inc. (California)
Century Electric Co. (Mo.)
Leland Electric Co., Inc. (Ohio)
Munning & Munning, Inc. (N.J.)
Sturtevant, B. F. Co. (Massachusetts)

Heating Coils
Wiegand, Edwin L. Co. (Pa.)

Hose, flexible metal
Eclipse-Pioneer Division (N.J.)
Bendix Aviation Corporation

Hot plate
Albert, L. & Son (N.J.)
Cambridge Instrument Co. (N.Y.)
Cavagnaro, John J. (N.J.)
Electric Heater Co., The (Conn.)
Elmes Engr. Wks. of Amer. Steel Foundries (Ill.)
Farrel-Birmingham Co., Inc. (Conn.)
Francis, Chas. E. Co. (Ind.)
Grant Research Laboratory (Ill.)
Improved Paper Machinery Corp. (New Hampshire)
Industrial Equipment Co. (N.J.)
Loomis, Evarts G. Co. (N.J.)
Trent, Harold E. (Pennsylvania)
Universal Hydraulic Machinery Co. (New York)
Walton Electric Mfg. Co. (Mo.)

Humidity indicator, controller, recorder, regulator
American Instrument Co. (Md.)
Bristol Company of Canada, Ltd. (Ontario, Canada)
Bristol Co., The (Conn.)
Brown Instrument Co., The (Pa.)
Foxboro Company, The (Mass.)
Gotham Instrument Co. (N.Y.)
Illinois Testing Laboratories, Inc. (Illinois)
Leeds & Northrup Co. (Pa.)
Portable Products Corp. C. J. Tagliabue Div. (New York)
Taylor Instrument Co. (New York)
Tenney Engineering, Inc. (N.J.)

Hydraulic fluids, water pump
Aircraft Tools, Inc. (California)
Albert, L. & Son (N.J.)
Aldrich Pump Company, The (Pa.)
Baldwin Southwark Division (Pa.) Baldwin Locomotive Works, The
De Laval Steam Turbine Co. (N.J.)
Devine, J. P. Mfg. Co., Inc. (Ill.)
Dorr Patterson Engr. Co. (Mich.)
Dunning & Boschert Press Co. (New York)
Elmes Engr. Wks. of Amer. Steel Foundries (Illinois)
First Machinery Corp. (New York)
French Oil Mill Machinery Co. (O.)
Industrial Equipment Co. (N.J.)
Keckley, O. C. Co. (Ill.)
Logansport Machine Co., Inc. (Ind.)
Loomis, Evarts G. Co. (New Jersey)
Oilgear Company, The (Wisconsin)
Reimuller Bros. Co. (Illinois)
Rodgers Hydraulic, Inc. (Minnesota)
Union Steam Pump Co. (Michigan)
Universal Hydraulic Machinery Co. (New York)
Warren Steam Pump Co., Inc. (Massachusetts)
Watson Stillman Co. (New Jersey)
Worthington Pump & Machinery Corporation (New Jersey)

Hydraulic pressure gage
Mansfield & Green (Ohio)

Hydraulic power unit
Acromark Company, The (N.J.)
Barber, F. F. Machinery Company (Ontario, Canada)
Electric Heater Co., The (Conn.)
Elmes Engr. Wks. of Amer. Steel Foundries (Illinois)
Ex-Cell-O Corporation (Michigan)
Grant Research Laboratory (Ill.)
Hannifin Mfg. Co. (Ill.)
Hisgen Machine Tool Wks. (Calif.)
Hydraulic Machinery Inc. (Mich.)
Hydraulic Press Mfg. Co. (Ohio)
Industrial Equipment Co. (N.J.)
Miller Motor Co. (Ill.)
New York Air Brake Co. (N.Y.)
Pesco Products Company (Ohio)
Racine Tool & Machine Co. (Wis.)
Seely Instrument Co., Inc. (N.Y.)
Simplex Engineering Co. (Ohio)
Universal Hydraulic Machinery Co. (New York)
Vickers Inc. (Michigan)
Watson Stillman Co. (New Jersey)
Wood, R. D. Co. (Pennsylvania)

Industriel X-Rey Equipment
North American Philips Co., Inc. (New York)
X-Ray Products Co. (California)

Infra-red preheater
Adroit Manufacturing Co. (N.Y.)
Ansonia Clock Company, Inc. (N.Y.)
Despatch Oven Co. (Minn.)
Infra-Red Engineers & Designers (Ohio)
Kirk & Blum Mfg. Co., The (Ohio)
Leominster Tool Co., Inc. (Mass.)
Rockwell, W. S. Company (Conn.)
Ross, J. O. Engineering Corp. (N.Y.)
Young Brothers Co. (Michigan)

Kettle
Edge Moor Iron Works (Del.)
Cooper, D. C. Company (Illinois)

Lubricating equipment
Aro Equipment Corp. The (Ohio)
U.S. Air Compressor Co. (Ohio)

Magnetic equipment
Brosites Machine Co., Inc. (N.Y.)
Eriez Mfg. Co. (Pa.)
Stearns Magnetic Mfg. Co. (Wis.)

Magnetic seperetors
Dings Magnetic Separator Co. (Wis.)

Meter
Cambridge Instrument Co. (N.Y.)

Milling machine spacer
Industrial Products Suppliers (N. Y.)

Mixer
Edge Moor Iron Works (Del.)
Grant Research Laboratory (Ill.)

Motor, electric
Aircraft Tools, Inc. (California)
Allis-Chalmers Mfg. Co. (Wis.)
Baldor Electric Co. (Missouri)
Century Electric Co. (Mo.)
Fray Machine Tool Co. (Calif.)
Kimble Electric Division (Illinois) Miehle Ptg. Press & Mfg. Co.
Leland Electric Co., Inc. (Ohio
Small Motors, Inc. (Illinois)
Sturtevant, B. F. Co. (Massachusetts)
Wagner Electric Corp. (Missouri

Motor, pneumetic
Barber, F. F. Machinery Company (Ontario, Canada)
Bellows Company, The (Ohio)
Brown Instrument Co., The (Pa.)
Ferriot Brothers, Inc. (Ohio)
Independent Pneumatic Tool Co. (Illinois)
Industrial Equipment Co. (N.J.)
Onsrud Machine Works, Inc. (Ill.
Rodgers Hydraulic, Inc. (Minnesot.

Oil Heeter
Youngstown Miller Co. (New Jersey

Oil Purifier
Youngstown Miller Co. (New Jersey

Oven
Aircraft Tools, Inc. (California)
American Instrument Co. (Marylan
Blodgett, G. S. Co., Inc. (Vt.)
Kirk & Blum Mfg. Co., The (Ohio
Lydon Brothers (N.J.)
National Ruhber Machinery Co. (O
Surface Combustion (Ohio)
*Young Brothers Co. (Michigan)
Young & Bertke Company (Ohio)

Permenent magnet
Dings Magnetic Separator Co. (Wisconsin)

Photoelectric control
Durant Manufacturing Co. (Wis.
General Electric Co. (N.Y.)
Portable Products Corp. J. C. Tagliahue Div. (New York
United Cinephone Corp. (Conn).

Power driver for screws
Bourke & Mabee (Ont., Can.)
Errington Mechanical Laboratory (New York)
Haffling Company, E. V. (Conn.)
Holm's Manufacturing Co. (Wis.)
Ideal Commutator Dresser Co. (Ill.

Power factor regulator
Barber, F. F. Machinery Company (Ontario, Canada)
Modern Control Equipment Compan (Illinois)

Press plete polishing
Albert, L. & Son (N.J.)
Baldwin Southwark Division (Pa.
Cavagnaro, John J. (N.J.)
Industrial Equipment Co. (N.J.)
Loomis, Evarts G. Co. (New Jersey

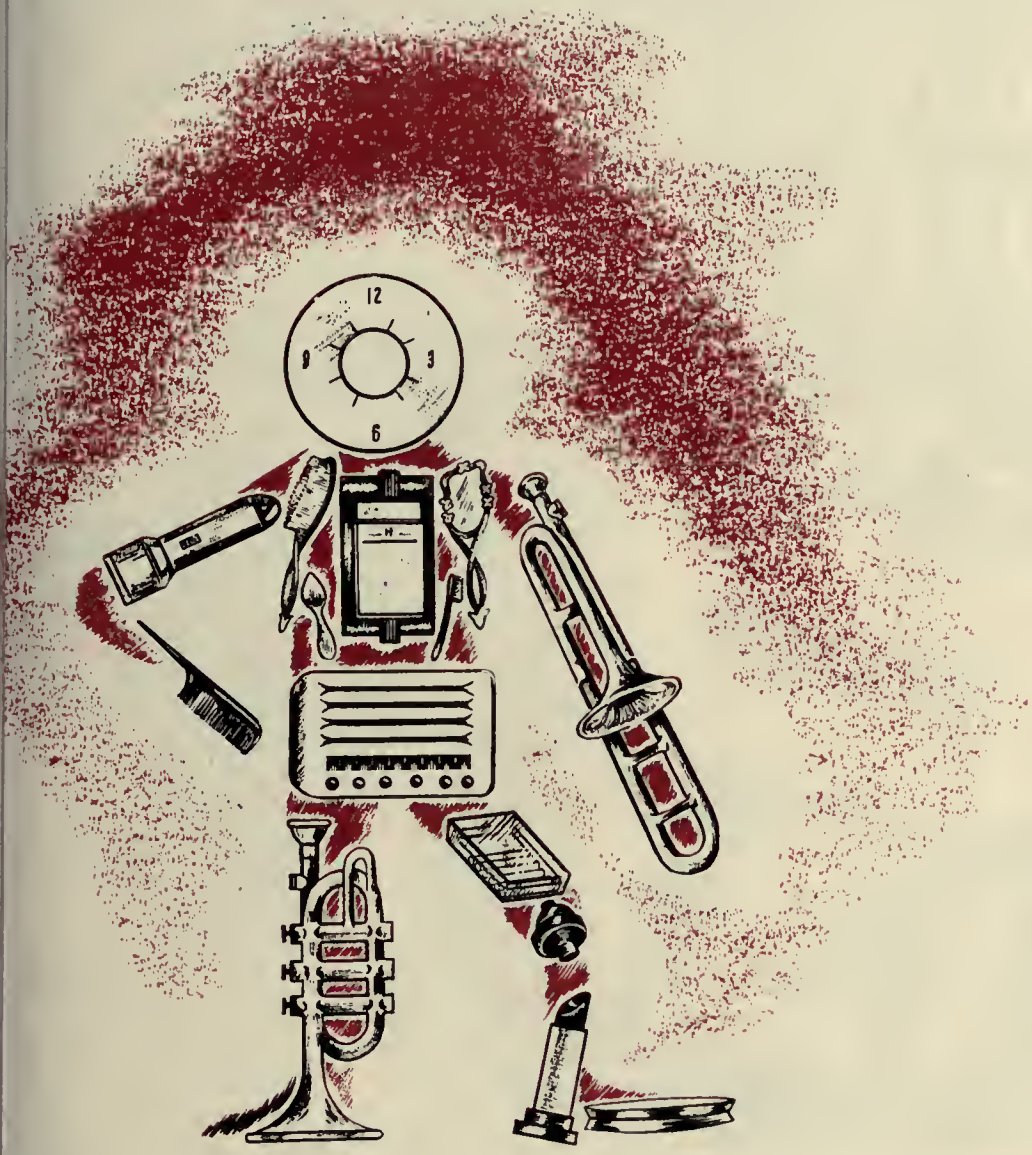
Presser plete
Apollo Metal Works (Ill.)

Pressure controller, regulator
Dunning & Boschert Press Co. (New York)

Pressure indicetor, controller, recorder, regulator
Aircraft Tools, Inc. (California)
ATC Co., Inc. (Pa.)
Albert, L. & Son (N.J.)
Bailey Meter Co. (Ohio)
Bastian-Blessing Co. (Illinois)
Bristol Company of Canada, Ltd. (Ontario, Canada)
Brown Instrument Co., The (Pa.)
Brush Development Co., The (Ohio
First Machinery Corp. (New York
Foxboro Company, The (Mass.)
Gotham Instrument Co. (N.Y.)
Industrial Equipment Co. (N.J.)
Keckley, O. C. Co. (Ill.)
Loomis, Evarts G. Co. (New Jersey)
Portable Products Corp. (New York
Republic Flow Meters Co. (Illinois
Seely Instrument Co., Inc. (N.Y.)
Taylor Instrument Co. (New York

Pumping unit
Albert, L. & Son (N.J.)
Allis-Chalmers Mfg. Co. (Wis.)
American Engineering Co. (Pa.)
American-Marsh Pumps, Inc. (Michigan)
Aldrich Pump Company, The (Pa.
Buffalo Forge Co. (New York)
Dunning & Boschert Press Co. (New York)
Elmes Engr. Wks. of Amer. Stee Foundries (Illinois)
Francis, Chas. E. Co. (Ind.)
Grant Research Laboratory (Ill.)
Industrial Equipment Co. (N.J.)
Nash Engineering Co. (Conn.)
New York Air Brake Co., The (N.Y.)
Oilgear Company, The (Wisconsin
Racine Tool & Machine Co. (Wis.)
Simplex Engineering Co. (Ohio)
Universal Hydraulic Machinery Co (New York)
Vickers Inc. (Michigan)
Warren Steam Pump Co. (Mass.)
Watson Stillman Co. (New Jersey)
Worthington Pump & Machinery Corporation (New Jersey)

[*Manufactures laboratory equipment.]



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[MACHINERY, MISC.] Cont.

Pyrometer
Albert, L. & Son (N.J.)
American Instrument Co. (Maryland)
Bailey Meter Co. (Obio)
Bristol Company of Canada Ltd. (Ontario, Canada)
Bristol Co., The (Conn.)
Brown Instrument Co. (Pa.)
Cambridge Instrument Co., Inc. (New York)
Engelhard, Charles, Inc. (N.J.)
Foxboro Company, The (Mass.)
General Electric Co. (N.Y.)
Illinois Testing Laboratories, Inc. (Illinois)
Leeds & Northrup Co. (Pa.)
Portable Products Corp. J. C. Tagliabue Div. (New York)
Pyrometer Instrument Co. (N.Y.)
Wheelco Instruments Co. (Illinois)

Reaction Kettles
Devine, J. P. Mfg. Co. (Illinois)
First Machinery Corp. (New York)
International Engineering, Inc. (O.)

Refrigeration
Carrier Corporation (New York)
Frostrode Products (Michigan)

Relays, time delay
Automatic Temperature Control Co., Inc. (Pa.)
Paragon Electric Company (Illinois)

Retorts
Devine, J. P. Mfg. Co. (Illinois)
First Machinery Corp. (New York)

Rivet Setting
Milford Rivet & Machine Co. (Ohio)

Roll Leaf Feeding Attachment
Peerless Roll Leaf Co., Inc. (N.J.)

Rotary File
Severance Tool Industries, Inc. (Michigan)

Scrap Granulators
National Rubber Machinery Co. (O.)
Thwing-Albert Instrument Co. (Ill.)

Scrap grinding
Albert, L. & Son (N.J.)
American Pyroxylin Co. (N.J.)
Brosites Machine Co., Inc. (N.Y.)
Gruendler Crusher & Pulverizer Co. (Illinois)
Industrial Equipment Co. (N.J.)
Industrial Screw Co. (Ill.)
Leominster Tool Co. Inc. (Mass.)
Cumberland Engineering Co. (R.I.)
Sprout, Waldron & Co. (Pa.)
Pulverizing Machinery Co. (N.J.)

Screw Drivers, Flexible
Miller, L. B. Co. (New York)

Screw Extractors
Chicago-Latrobe Twist Drill Works (Illinois)

Seperators
Dings Magnetic Separator Co. (Wis.)

Sequence Timers
Paragon Electric Company (Illinois)

Socket sets
Bristol Co., The (Conn.)
Chicago-Latrobe Twist Drill Works (Illinois)
Miller, L. B. Co. (New York)
Severance Tool Industries, Inc. (Michigan)

Soldering tool
Luma Electric Equipment Co. (Ohio)

Speed reducer
Albert, L. & Son (N.J.)
Allis-Chalmers Mfg. Co. (Wis.)
Cone-Drive Division (Mich.) Machine Tool Co.
Farrel-Birmingham Co., Inc. (Conn.)
Foote Bros. Gear & Machine Corp. (Illinois)
General Electric Co. (N.Y.)
Improved Paper Machinery Corp. (New Hampshire)
Industrial Equipment Co. (N.J.)
Philadelphia Gear Works, Inc. (Pa.)
Universal Hydraulic Machinery Co. (New York)

Spindle
Ex-Cell-O Corporation (Michigan)
Onsrud Machine Works, Inc. (Ill.)
Root, B. M. Company (Pennsylvania)

Sprey Nozzles
Spray Engineering Co. (Mass.)

Steem trap
D'Este, Julian Div. (Pa.)
Industrial Equipment Co. (N.J.)
Keckley, O. C. Co. (Ill.)
Nicholson, W. H. & Co. (Penna.)
Sarco Company, Inc. (New York)
Seely Instrument Co., Inc. (N.Y.)
Yarnall-Waring Company (Pa.)

Steem Turbines
Worthington Pump & Machinery (New Jersey)

Tenk pressure
Edge Moor Iron Works (Del.)

Teper pins
Industrial Screw Co. (Ill.)

[MACHINERY, MISC.] Cont.

Tepping
Haffling, E. V. Company (Conn.)

Temperature indicetor, controller, recorder, reguletor
Aircraft Tools, Inc. (California)
ATC Co., Inc. (Pa.)
Albert, L. & Son (N.J.)
American Instrument Co. (Md.)
Automatic Temperature Control Co., Inc. (Pa.)
Bailey Meter Co. (Obio)
Bristol Co., The (Conn.)
Bristol Company of Canada, Ltd. (Ontario, Canada)
Brown Instrument Co., The (Pa.)
Burling Instrument Company (N.J.)
Combustion Control Corp. (Mass.)
Engelhard, Charles, Inc. (N.J.)
Fenwall, Inc. (Mass.)
Ferner, R. Y. Co., The (Mass.)
First Machinery Corp. (New York)
Foxboro Company, The (Mass.)
Gotham Instrument Co. (N.Y.)
Illinois Testing Laboratories, Inc. (Ill.)
Improved Paper Machinery Corp. (New Hampshire)
Industrial Equipment Co. (N.J.)
Johnson Service Co. (Wis.)
Keckley, O. C. Co. (Ill.)
Leeds & Northrup Co. (Pa.)
Munning & Munning, Inc. (N.J.)
Portable Products Corp. J. C. Tagliabue Div. (New York)
Republic Flow Meters Co. (Illinois)
Sarco Company, Inc. (New York)
Seely Instrument Co., Inc. (N.Y.)
Taylor Instrument Co. (New York)
Tenney Engineering, Inc. (N.J.)
Thwing-Albert Instrument Co. (Ill.)
Wheelco Instruments Co. (Illinois)
Weston Electrical Instrument Corp. (New Jersey)
Wiegand, Edwin L. Co. (Pa.)

Thermocouples
Engelhard, Charles, Inc. (N.J.)

Timing indicetor, controller, recorder, reguletor
Aircraft Tools, Inc. (California)
ATC Co., Inc. (Pa.)
Albert, L. & Son (N.J.)
Automatic Temperature Control Co., Inc. (Pa.)
Bristol Company of Canada, Ltd. (Ontario, Canada)
Cramer, R. W. Co., Inc. (Conn.)
Diana Clock Works (Illinois)
Eagle Signal Corporation (Ill.)
First Marchinery Corp. (New York)
General Electric Co. (N.Y.)
Grant Research Laboratory (Ill.)
Industrial Equipment Co. (N.J.)
Laboratory Specialties, Inc. (Ind.)
National Acme Co., The (Ohio)
Paragon Electric Company (Illinois)
Photoswitch, Inc. (Massachusetts)
Pond Engineering Company (Mass.)
Portable Products Corp. C. J. Tagliabue Div. (New York)
Seely Instrument Co., Inc. (N.Y.)
Taylor Instrument Co. (New York)
United Cinephone Corp. (Conn.)
Weltronic Comnany (Michigan)

Tools, essembling end dismentling
Acme-Danneman Co., Inc. (N.Y.)
Ajax-Doret Metal Products Limited (Ontario, Canada)
Aro Equipment Corp. The (Ohio)
Barber, F. F. Machinery Company (Ontario, Canada)
Bicknell-Thomas Co. (Mass.)
Black & Decker Mfg. Co., The (Md.)
Bourke & Mabee (Ont., Can.)
Criterion Machine Works (Calif.)
Electric Heater Co., The (Conn.)
Genesee Tool Company (Michigan)
Imperial Brass Mfg. Co. (Illinois)
Independent Pneumatic Tool Co. (Illinois)
Keystone Machine Corp. (N.J.)
Plomh Tool Company (California)
Pond Engineering Co. (Mass.)
Scully-Jones & Company (Illinois)
Vascoloy-Ramet Corn. (Illinois)

Torches
Harris Calorific Company (Ohio)
Holm's Manufacturing Co. (Wis.)
Unique Mfg. Co., Inc. (Illinois)

Torque Wrenches
Apco Mossberg Company (Mass.)

Transformer
American Transformer Co. (N.J.)
Sola Electric Co. (Illinois)

Tubes, heeting preforms
Taylor Tubes, Inc. (Illinois)

Tubes, high frequency
Federal Telephone and Radio Corp. (New Jersey)
General Electric Co. (N.Y.)

Velves
Automatic Temperature Control Co., Inc. (Pennsylvania)
Baldwin Southwark Division (Pa.)
Barber, F. F. Machinery Company (Ontario, Canada)
Bastian-Blessing Company (Illinois)
Birdsboro Steel Foundry & Machine Company (Pennsylvania)
Bristol Company of Canada, Ltd. (Ontario, Canada)
Bristol Co., The (Conn.)
Carver, Fred S. (New York)
Dunning & Boschert Press Co. (N.Y.)
Elmes Engr. Wks. of Amer. Steel Foundries (Ill.)
First Machinery Corp. (New York)
French Oil Mill Machinery Co. (O.)
Foxboro Company, The (Mass.)
Grant Research Laboratory (Ill.)
Hydraulic Press Mfg. Co. (Obio)
Industrial Equipment Co. (N.J.)
Keckley, O. C. Co. (Ill.)
Kinney Mfg. Co. (Mass.)
Logansport Machine Co., Inc. (Ind.)
Loomis, Evarts G. Co. (New Jersey)
New York Air Brake Co., The (N.Y.)
Nicholson, W. H. & Co. (Pa.)
Oilgear Company, The (Wisconsin)
Portable Products Corp. C. J. Tagliahue Div. (New York)
Racine Tool & Machine Co. (Wis.)
Reimuller Bros. Co. (Illinois)
Rockwell, W. S. Company (Conn.)
Seely Instrument Co., Inc. (N.Y.)
Sundstrand Machine Tool Co. (Ill.)
Taylor Instrument Co. (New York)
Tenney Engineering, Inc. (N.J.)
Vickers Inc. (Michigan)
Walworth Company (New York)
Watson Stillman Co. (New Jersey)
Wood, R. D. Co. (Pennsylvania)
Yarnall-Waring Company (Pa.)

Verieble delivery pumps
Aldrich Pump Co., The (Pa.)
Ideal Commutator Dresser Co. (Ill.)
Industrial Equipment Co. (N.J.)

Verieble speed drive
Aircraft Tools, Inc. (Calif.)
Albert, L. & Son (N.J.)
Allis-Chalmers Mfg. Co. (Wis.)
American Blower Corp. (Mich.)
Bourke & Mabee (Ont., Can.)
Continental Machines, Inc. (Minn.)
DoAll Co., The (Minn.)
Electron Equipment Corp. (Calif.)
First Machinery Corp. (N.Y.)
General Electric Co. (N. Y.)
Holm's Manufacturing Co. (Wis.)
Oilgear Company, The (Wis.)
Sundstrand Machine Tool Co. (Ill.)
Universal Hydraulic Machinery Co. (New York)
Vickers Inc. (Michigan)
Worthington Pump & Machinery Corp. (New Jersey)

Viscometers
American Instrument Co. (Md.)

Vise, pneumetic
Bellows Company, The (Obio)
Neal & Brinker Co. (New York)
Reimuller Bros. Co. (Illinois)

Weighing device
Chatillon, John, & Sons (New York)
Holm's Manufacturing Co. (Wis.)
Howe Scale Company, The (Vt.)
Lufkin Rule Co., The (Michigan)
Yale & Towne Mfg. Co. (Pa.)

Woodworking mechinery
Albert, L. & Son (N.J.)
Beech Manufacturing Company (Pa.)
Boice-Crane Company (Ohio)
Bourke & Mabee (Ont., Can.)
Buss Machine Works (Michigan)
Francis, Chas. E. Co. (Ind.)
Industrial Equipment Co. (N.J.)
Muskegon Machine Co., Inc. (N.Y.)
Oliver Machinery Co. (Michigan)
Preston Woodworking Machinery Co., Ltd. (Ontario, Canada)
Spiegel Sales Co. (Michigan)
Sterling Tool Products Co. (Illinois)
Universal Hydraulic Machinery Co. (New York)
Walker-Turner Co., Inc. (N.J.)

Wrenches
Billings & Spencer Co. (Conn.)

POWER PLANT

Boiler end eccessories
Babcock & Wilcox Co., The (N.Y.)
Commonwealth Electric & Mfg. Co. (Massachusetts)
Dutton, C. H. Co., The (Mich.)
Eclipse Fuel Engineering Co. (Ill.)
Edge Moor Iron Works (Del.)
Grant Research Laboratory (Ill.)
Industrial Equipment Co. (N.J.)
Mears-Kane-Ofeldt, Inc. (Pa.)
Pioneer Mold Co. (Ohio)
Royal Moulding Co. (Rhode Island)
Schauh, Fred H. Engineering Co., Inc. (Illinois)
Struthers Wells Corp. (Pa.)
Yarnall-Waring Company (Pa.)

Combustion sefeguerd
Automatic Temperature Control Co., Inc. (Pennsylvania)
Bailey Meter Co. (Ohio)
Brown Instrument Co., The (Pa.)
Dutton, C. H. Co., The (Mich.)
Wheelco Instruments Co. (Ill.)

[MACH., POWER PLANT] Cont.

Condenser
Allis-Chalmers Mfg. Co. (Wis.)
Nooter, John Boiler Works Co. (Mo.)
Struthers Wells Corp. (Pa.)

Electric power generating & controlling equipment
Aircraft Tools, Inc. (California)
ATC Co., Inc. (Pa.)
Allis-Chalmers Mfg. Co. (Wis.)
Automatic Temperature Control Co., Inc. (Pennsylvania)
Bristol Company of Canada, Ltd. (Ontario, Canada)
Dutton, C. H. Co., The (Mich.)
General Electric Co. (N.Y.)
Hisgen Machine Tool Wks. (Calif.)
Industrial Equipment Co. (N.J.)
Leeds & Northrup Co. (Pa.)
Lovejoy Flexible Coupling Co. (Ill.)
Munning & Munning, Inc. (N.J.)
Sturtevant, B. F. Co. (Mass.)
Trumhull Electric Mfg. Co. (Conn.)

Oil burner
Lammert and Mann Co. (Ill.)

Underfeed end spreeder stokers
American Engineering Co. (Pa.)

Weter purification equipment
Allis-Chalmers Mfg. Co. (Wis.)
Dutton, C. H. Co., The (Mich.)
Pioneer Mold Co. (Ohio)
Worthington Pump & Machinery Corp. (New Jersey)

Weter selvege system
Aircraft Tools, Inc. (California)
Devine, J. P. Mfg. Co., Inc. (Ill.)
Dutton, C. H. Co., The (Mich.)
First Machinery Corp. (New York
Hisgen Machine Tool Wks. (Calif.
Schaub, Fred H. Engineering Co., Inc. (Illinois)

MOLDERS

(Bold face listings indicate companies who menufecture their own molds end dies.)

BLOW

Artcraft Plastics, Inc. (Minn.)
Cadillac Plastic Company (Mich.)
California Plastics Div. E. D. Bullard Co. (Calif.)
Columbia Engineering Co. (N.J.)
Design Center, Inc. (N.Y.)
Eastern Plastics, Inc. (Pa.)
Eldorado Mfg. Co. (Calif.)
General Plastics Corporation (Ind.)
Great American Plastics Co. (Mass.)
Hexco Products, Inc. (Ill.)
Hunton Plastics Co. (N.J.)
Industrial Plastics Corp. (Wis.)
Irwin Corporation (N.Y.)
King Plastics Corp. (Colo.)
Klise Manufacturing Co. (Mich.)
Lee Plastics (Pa.)
Plax Corporation (Conn.)
Ranger-Tennere, Inc. (N.Y.)
Shoe Form Company, Inc. (N.Y.)
Southern Plastics Company (S.C.)
Technical Plastics Labs. (Calif.)
Tray-Ware, Inc. (Ohio)
U. S. Plastic Co. (Calif.)
Wesco Products (Calif.)
Western Plastics, Ltd. (B.C., Can.)
Whiteford Plastics Co., Inc. (N.Y.)
Wills & Roberts Plastics Mfg. Corp. (California)

CASTING

Arelay Plastics Products (Calif.)
Art Plastic Company (N.Y.)
Atlas Plastic Industries (Md.)
Axel Plastic Button Company (N.Y.)
Beaman Molded Products Co. (Ore.)
Brilhart, Arnold, Ltd. (N.Y.)
Buchsbaum, S. & Co. (Ill.)
California Plastics Div. E. D. Bullard Co. (Calif).
Celluplastic Corporation (N.J.)
Corbin Engineering & Sales Co. (California)
Crosley Marine (Fla.)
Crown Plastic Fahricating Co. (Ill.)
Cuker Process Company (N.Y.)
Decora Plastic Studios (Mich.)
Die-Plast Co., Ltd. (Que., Can.)
Genii Corporation, The (Ohio)
HR Engineering Company (Ind.)
Haveg Corporation (Del.)
Hexco Products, Inc. (Ill.)
Industrial Plastics Corp. (Wis.)
K-Plastix (Calif.)
Keller Products (N.H.)
Kerr, R. W. Co. (Nebr.)
King Plastics Corp. (Colo.)
Lifetime Plastic, Inc. Colo.)
Maico Co., Inc. (Minn.)
Marco Chemicals, Inc. (N.J.)
Mildern Mfg. Co. (N.Y.)
Mill-O-Plast (N.Y.)
National Sculpture Services (N.Y.)
Neo A Corporation (N.Y.)
Neo Designs Co. (N.Y.)
New Plastic Corporation (Calif.)
(Cont. on pg. 128)

Custom INJECTION MOLDED PLASTICS

DESIGNED
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PRODUCED

Whether you require plastic parts or finished products . . . we can do the job. Our facilities include every detail from making the mold to the final assembly of your product, and our competent staff is always at your service.

Specialists in — CELLULOSE ACETATE, BUTYRATE ACETATE, POLYSTYRENE, VINYLITE, LUCITE AND OTHER SIMILAR THERMOPLASTIC MATERIALS.

Injection molding capacity — 4 ozs. to 22 ozs.

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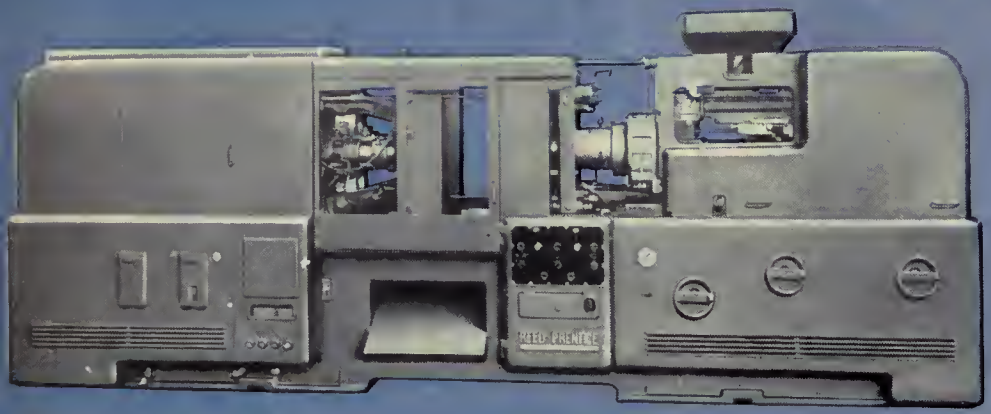
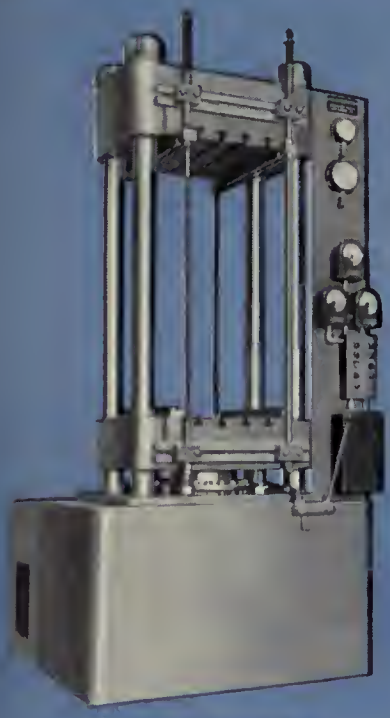
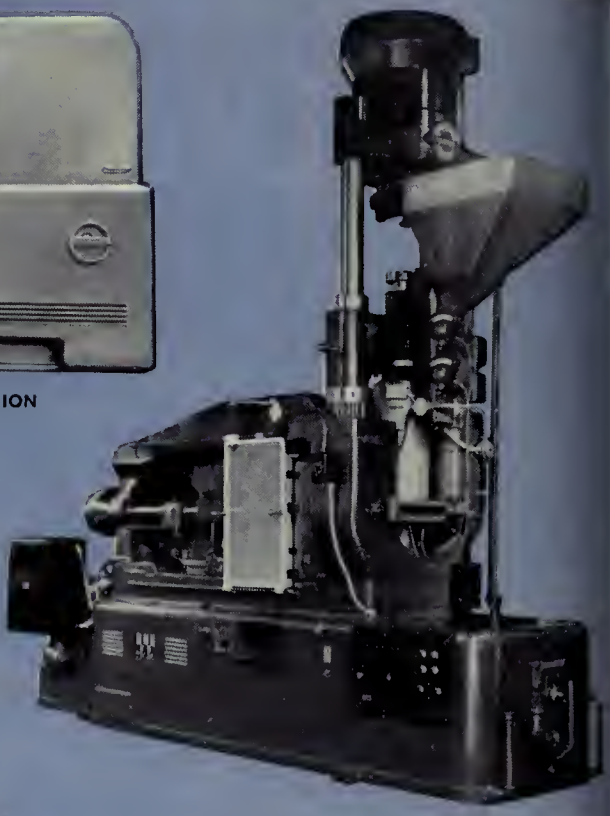
VICKERS



REED-PRENTICE CORPORATION



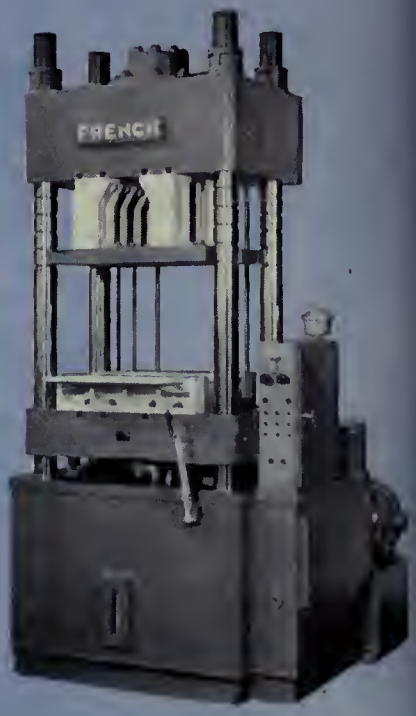
LESTER-PHOENIX, INCORPORATED



ELMES ENGINEERING WORKS OF AMERICAN STEEL FOUNDRIES

LAKE ERIE ENGINEERING CORPORATION

F. J. STOKES MACHINE COMPANY



THE FRENCH OIL MILL MACHINERY CO.

HYDRAULIC CONTROLS

An All-Important Component of Modern HIGH-PRODUCTION Plastic Molding Machinery

TONS OF POWER IN SPLIT-SECOND TIMING CYCLES

The modern plastic molding machines illustrated here are representative of the many that use Vickers hydraulic equipment. There are a number of good reasons for this almost universal preference for Vickers Hydraulic Controls. Important among them are the accurate and unvarying control of pressure and cycle timing that assure product uniformity and permit minimum product tolerances. The fully automatic control they provide speeds production and cuts costs.

Flexibility is another important characteristic of Vickers Hydraulic Controls. The control cycle on Vickers-equipped machines can be altered easily to accommodate changes in material characteristics and product requirements. Yet when established, the new control cycle is always followed precisely. Thus, a Vickers-equipped machine will provide the most economical production cycle for a wide variety of parts and conditions.

Vickers Hydraulic Controls can automatically protect the machine against excessive pressure due to mechanical failure or improper material characteristics—against mistakes and abuse.

Vickers Hydraulic Controls are therefore important components of modern, high-production plastic molding equipment.

VICKERS INCORPORATED • 1400 OAKMAN BLVD., DETROIT 32, MICHIGAN

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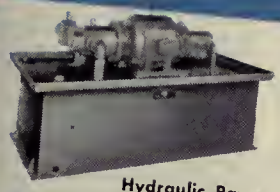
ROCKFORD • TULSA • WORCESTER

REPRESENTATIVE OF MORE THAN 5000 STANDARDIZED VICKERS UNITS For Every Hydraulic Power and Control Function


Hydraulic Pawer Units.

Twa-Stage Pumps.

Variable Delivery Pumps.

Manually Operated 4-Way Valves.

Relief Valves.

Pilat Valves (Plunger Type).

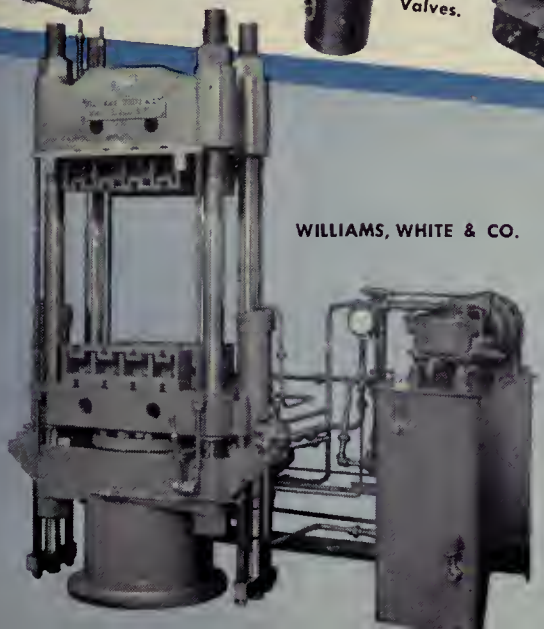
Two-Pressure, Large-Small Volume Pumps.

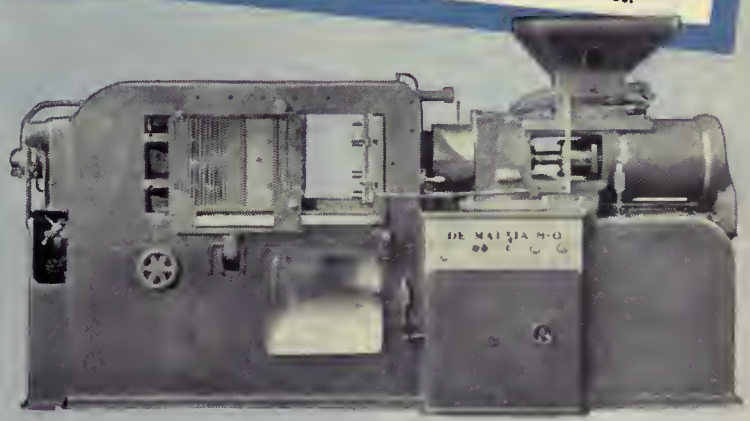
Reducing Valves.

Salenoid Cantrol Pilat Operated 4-Way Valves.

Pilot Valves (Ratary Type)

Adjustable Flaw Cantral Valves.


WILLIAMS, WHITE & CO.



DE MATTIA MACHINE & TOOL COMPANY

Optical Plastics Company (N.Y.)
Paragon Plastic Corporation (N.Y.)
Plasteel (Calif.)
Rezolin Company, The (Calif.)
Solid-Art Company (Md.)
Stokes, A. Company (Ohio)
Teckna Company (N.Y.)
U. S. Plastic Co. (Calif.)
United States Stoneware Co. (Ohio)
Walker Plastic Co. (Calif.)
Wesco Products (Calif.)
Western Plastics, Ltd. (B.C., Can.)
Wills & Roberts Plastics Mfg. Corp. (Calif.)

COLD

American Flower Works (Calif.)
American Insulator Corp. (Pa.)
Avedon Sales Co. (N.Y.)
Burwood Products Company (Mich.)
Cambridge Paper Box Co. (Mass.)
Canadian General Electric Company (Ontario, Canada)
Columbia Engineering Co. (N.J.)
Crown Plastic Fabricating Co. (Ill.)
Garfield Manufacturing Co. (N.J.)
General Electric Co., Plastics Div. (Massachusetts)
King Plastics Corp. (Colo.)
La Pointe-Plascomold Corp. (Conn.)
Lifetime Plastic, Inc. (Colo.)
Marco Chemicals, Inc. (N.J.)
Mill-O-Plast (N.Y.)
Paragon Plastic Corporation (N.Y.)
Plastic Molding Corp. (Conn.)
Ranger-Tennere, Inc. (N.Y.)
Robb, Jos. & Co., Ltd. (Que., Can.)
Skowbegan Manufacturers, Inc. (Me.)
Synthetic Plastics Co. (N.J.)
T-Die Cast & Molded Products (California)
Technical Plastics Labs. (Calif.)
United States Stoneware Co., (Obio)

COMPRESSION

Abar Plastics Company (Pa.)
Acadia Synthetic Products Div. Western Felt Works (Ill.)
Accurate Molding Corporation (N.Y.)
Ace-Hy Plastic Co. (N.Y.)
A. J. & K. Company (N.Y.)
A. C. Rubber Mfg. Co., Ltd. (British Columbia, Canada)
Ackerman Plastic Molding (Obio)
Acraglas Co. (Calif.)
Alan, Richard Button Co. (N.Y.)
Alden Producta Company (Mass.)
All American Aircraft Products, Inc. (California)
All Metal Screw Products (N.Y.)
All Plastics, Inc. (N.J.)
Allanson Armature Mfg. Co., Ltd., The (Ontario, Canada)
Amatoy Corporation (Ill.)
American Brakeblok Division American Brake Shoe Co. (Mich.)
American Denture Corp. (Ore.)
American Flower Works (Calif.)
American Hard Rubber Company (N.Y.)
American Insulator Corp. (Pa.)
American Molding Co. (Calif.)
American Plastic Mfg. Co. (Ill.)
American Products Mfg. Co. (La.)
American Specialties Mfg. Co. (California)
American Viscose Corp. (Del.)
Amity Plastics Co., Inc. (N.Y.)
Armstrong Cork Company (Pa.)
Art Plastic Company (N.Y.)
Art Plastics Co. (Calif.)
Art Plastics Mfg. Co. (Calif.)
Artcraft Plastics, Inc. (Minn.)
Atlas Plastic Industries (Md.)
Auburn Button Works, Inc. (N.Y.)
Austenal Laboratories, Inc. (N.Y.)
Automatic Plastic Molding Company (Calif.)
Avedon Sales Co. (N.Y.)
Ballard Plastics Corp. (Wash.)
Bangor Plastics, Inc. (Mich.)
Barber Colman Co. (Ill.)
Barnes, Ralph Moulded Plastics (California)
Barringham Rubber Company Limited (Ont., Can.)
Beacon Industrial Engineering Service (New York)
Beamsn Molded Products Co. (Ore.)
Berkeley Engineering & Manufacturing Company (N.J.)
Bergwood Molding Co. (Mo.)
Barwood Products Co., Inc. (Ill.)
Bolta Company, The (Mass.)
Boonton Molding Co. (N.J.)
Boston Plastic Molding Co. (Mass.)
Breyer Molding Co. (Ill.)
Bridgeport Moulded Products Inc. (Conn.)
Brilhart, Arnold Ltd. (N.Y.)
Broder Industries, Inc. (N.Y.)
Bryant Electric Co., The (Conn.)
Buchsbaum, S. & Co. (Ill.)
Burton Mfg. Co. (Ill.)
Burwood Products Company (Mich.)
Butterfield, T. F., Inc. (Conn.)
Button Corporatton of America (N.J.)
C. M. Plastic Molding Co. (N.J.)
California Plastic Moulding Co. (California)
California Plastics Div. E. D. Bullard Co. (California)
Canadian Button, Ltd. (Que., Can.)
Canadian General Electric Company (Ontario, Canada)
Canadian General Rubber Co., Ltd. (Ontario, Canada)
Capac Manufacturing Co. (Mich.)
Central Engineering & Plastic Co. (Ohio)
Central Macbine Works Co. (Minn.)
Century Plastics Corporation (Ill.)
Chicago Die Mold Corp. (Ill.)
Chicago Molded Products Corporation (Illinois)
Chicago Plastic Mfg. Co. (Ill.)
Cburcb, C. F. Mfg. Co. (Mass.)
Cinch Manufacturing Corp. (Ill.)
Cincinnati Advertising Products Co., The (Ohio)
Cincinnati Molding Co. (Ohio)
Cleveland Plastics, Inc. (Ohio)
Climax Mfg. & Molding Corp. (Obio)
Colt's Patent Fire Arms Mfg. Co. (Connecticut)
Columbia Engineering Co., Inc. (New Jersey)
Commercial Plastics Co. (Ill.)
Compression Molding Co. of St. Louis (Missouri)
Conn. Hard Rubber Co. (Conn.)
Conn. Valley Plastics Corp. (Mass.)
Consolidated Molded Prod. Corp. (Pennsylvania)
Continental Can Co., Inc. (Ohio)
Continental-Diamond Fibre Co. (Del.)
Corbin Engineering & Sales Co. (California)
Creative Plastics Corp. (N.Y.)
Cunningham, W. W. Co. (Kan.)
Curvlite Products, Inc. (N.Y.)
D & P Molded Products Co. (California)
Dandy Plastic Products Co. (N.Y.)
Davies, Harry Molding Company (Ill.)
Davis, Joseph Plastics Co. (N.J.)
Designs, Inc. (N.J.)
Detroit Molded Plastic Corp. (Mich.)
Dickten & Masch Mfg. Co. (Wis.)
Diemolding Corporation (N.Y.)
Die-Plast Co., Ltd. (Que., Can.)
Dimco Plastics (Ohio)
Dominion Button Mfrs., Ltd. (Ontario, Canada)
Dominion Rubber Co., Ltd. (Ontario, Canada)
Dominion Plastics Ltd. (Que., Can.)
Duall Molding Corp. (N.Y.)
Drell Novelty Mfg. Co., The (N.Y.)
Dugan & Krukemeier Mfg. Co. (Ind.)
Duplate Canada, Ltd. (Ont., Can.)
Duplex Die & Machine Co. (Calif.)
Eagle Plastica Corp. (N.Y.)
Eastern Plastics, Inc. (Pa.)
Ehy, Hugh H., Inc. (Pa.)
Eclipse Moulded Products Co. (Wis.)
Eldorado Mfg. Co. (Calif.)
Electric Auto-Lite Corp. (Mich.)
Electroforming Company (Wis.)
Electronic Mechanics, Inc. (N.J.)
Emleco Photo Accessories & Engineering Co. (California)
Emsig Manufacturing Co. (N.Y.)
Evans, Luther J. (Ill.)
Evans-Winter-Hebb, Inc. (Mich.)
Evelo Mfg. Co. (N.I.)
Firestone Industrial Products Co. (Ohio)
Formold Plastics (Ill.)
Frank, Aug. C. Co. (Pa.)
Gardner Taubes Corp. (N.Y.)
Garfield Mfg. Co. (N.J.)
Gebhard, Harry W. (Ill.)
Gem Plastics Co. (Calif.)
General Electric Co., Plastics Div. (Mass.)
General Industries Company, The (Ohio)
General Insulate Co., Inc. (N.Y.)
General Molded Products, Inc. (Ill.)
General Products Corp. (N.Y.)
General Plastic Products (Mich.)
Genii Corporation, The (Ohio)
Gerber Plastic Comnanv (Mo.)
Germanow-Simon Machine Co. (N.Y.)
Gibbs Manufacturing (Calif.)
Gibson-Jones Co. (N.Y.)
Glade Mfg. Co. (Ill.)
Gleich, Emanuel D. (N.Y.)
Globe Imperial Corp. (Ill.)
Grayhill (Ill.)
Greene Plastics (R.I.)
Grigoleit Company, The (Ill.)
Gulliksen, Wm. M. Mlg. Company (Mass.)
Haas Corporation, The (Mich.)
Hale Brothers, Ltd. (Que., Can.)
Haro Products, Inc. (N.Y.)
Hawley Products Company (Ill.)
Heckman Plastics Corp. (N.Y.)
Hill Plastics Co. (N.Y.)
Hoosick Engineering Co. (N.Y.)
Howard Manufacturing Corp. (Iowa)
Howard Plastics, Inc. (Mo.)
Huntington Rubber Mills (Ore.)
Hychex Products (Ill.)
Hydropack (Calif.)
Illini Molded Plastics (Ill.)
Imperial Molded Products Corporation (Ill.)
Industrial Molded Products Company (Ill.)
Industrial Rubber Goods Co. (Mich.)
Industrial Plastics Corp. (Wis.)
Industrial Pressing Co. (Conn.)
Ingersoll Plastics Company (N.J.)
Ingwersen Mfg. Co. (Colo.)
Injection Molding Co. (Mo.)
Inland Mfg. Div., General Motors Corp. (Ohio)
Insulation Mfg. Co., Inc. (N.Y.)
Insulation Products Company (Pa.)
International Molded Plastics, Inc. (Ohio)
Irwin Engineering & Mfg. Co. (California)
Jamison, H. (N.Y.)
K. C. Plastics Co. (Mo.)
K-Plastix (Calif.)
Kasin, V. A. Molded Products (California)
Keeler Brass Co. (Mich.)
Kellogg Switchboard & Supply Co. (Ill.)
Kenilwortb Plastics Molding Co. (N.J.)
Kenneth, Donald Co., The (Calif.)
Kerr, R. W. Co. (Nebr.)
Keyes Fibre Company (Me.)
Keystone Plastic Engring. Co. (Ill.)
Keystone Specialty Co. (Ohio)
Kinkead Industries, Inc. (Ill.)
King Plastics Corp. (Colo.)
Koller Craft Plastic Products, Inc. (Missouri)
Kuhn & Jacob Molding & Tool Co. (New Jersey)
Kurz-Kasch, Inc. (Ohio)
Lamson-Hubbard (Md.)
Lanfare Molded Products (Ohio)
La Pointe-Plascomold Corp. (Conn.)
Lifetime Plastic, Inc. (Colo.)
Lone Star Plastics Company (Texas)
Lowe, E. S. Co., Inc. (N.Y.)
Lyon Metal Products, Inc. (Ill.)
Lindenhurst Mfg. Co., Inc. (N.Y.)
McDonald Mfg. Co. (Calif.)
Mack, John & Son Molded Products (Illinois)
Mack Molding Co. (N.J.)
Magnetic Plastics Co. (Ohio)
Maico Co., Inc., The (Minn.)
Majestic Plastic Co., Inc. (Fla.)
Majestic Plastic & Specialty Co. (Fla.)
Manle Leaf Plastics Limited (Ont., Can.)
Marathon Corp. (Wis.)
Marco Chemicals, Inc. (N.J.)
Marcraft Plastics (Minn.)
Marks Products Co., Inc. (N.Y.)
Martindell Molding Co. (N.J.)
Marvland Plastics, Inc. (Md.)
Mayfair Molded Products Corp. (Ill.)
Mechanical Institute (N.J.)
Meissner Manufacturing Co. (Ill.)
Micamold Radio Corporation (N.Y.)
Michigan Molded Plastics, Inc. (Mich.)
Microtronics Corp. (N.Y.)
Midwest Molding & Manufacturing Comnany (Ill.)
Mill-O-Plast (N.Y.)
Mine Safety Appliances Company (Pa.)
Minneapolis-Honeywell Regulator Co. (Minnesota)
Minneapolis Plastic Molders, Inc. (Minnesota)
Mitchell Button Co. Limited, The (Ont., Can.)
Modern Plastics Corp. (Mich.)
Molded Insulatiou Company (Pa.)
Molded Products Corn. (Ill.)
Molnar, John E. (Mo.)
Moulded Plastic Specialties Reg'd. (Quebec, Canada)
Molding Corp. of America, Inc. (R.I.)
Morrell, George Corp. (Mich.)
Multi Products, Inc. (Ill.)
Multi-Products Tool Company (N.J.)
Mundet Cork Corp. (N.Y.)
Mycalex Corporation of America (N.J.)
National Fabricated Products (Ill.)
National Lock Co. (Ill.)
National Plastica, Inc. (Tenn.)
National Research & Mfg. Co. (Calif.)
National Tool & Manufacturing Company (N.J.)
Neo Plastic Products Company (N.Y.)
New Plastic Coporation (Calif.)
Niagara Insul Bake Specialty Company (New York)
Nichols Plastic & Engineering Co. (Calif.)
Norco Plastics Co. (Wis.)
Northeastern Molding Co. (Conn.)
Northeastern Plastics (Mass.)
Northern Industrial Chemical Co. (Mass.)
Northwest Plastics, Inc. (Minn.)
Northwestern Plastics Co. (Ill.)
Norton Laboratories, Inc. (N.Y.)
Nu-Dell Mfg. Co. (Ill.)
Oris Mfg. Co., Inc. (Conn.)
Pacific Plastic Products Co. (Calif
Palomar Plastics Co. (Calif.)
Paramount Plastics Mfg. Co. (Ill.
Parizek, Frank Mfg. Co. (Conn.)
Parker Appliance Company, The (Ohio)
Patent Button Co. of Tenn., Inc., The (Tenn.)
Paulis Plastics Co. (Calif.)
Peerless Mouled, Inc. (N.J.)
Peerless Molded Plastics, Inc. (O.
Penn-Plastics Corporation (Pa.)
Perfection Plastic Products (N.J.)
Peters Plastic Molding Co. (Mich.)
Pittsburgh Plastics Co. (Pa.)
Plano Molding Company (Ill.)
Plasteel (Calif.)
Plastic Appliance Co. (Pa.)
Plastic Craft, Inc. (Minn.)
Plastic & Die Cast Products Corpo ration (California)
Plastic and Rubber Products Com pany (Calif.)
Plastic Manufacturers, Inc. (Conn.)
Plastic Mold Engineering Co. (Michigan)
Plastic Molders, Inc. (Ill.)
Plastic Molding Corp. (Conn.)
Plastic Moldings Corp. (Ohio)
Plastic Process Company (Calif.)
Plastic Products, Inc. (Conn.)
Plastic Research Foundation (Mass
Plastic Research Products Labora tories (Ohio)
Plastic Specialties (Calif.)
Plastics Engineering Co. (Wis.)
Plastics, Inc. (Minn.)
Plastics Mfg. Co. of Calif. (Calif
Plastics Service Company (Wis.)
Plastimold, Inc. (Mass.)
Plastics, Inc. (Minn.)
Plastics Molding Company, The (Mo.)
Plastomatic Corporation (Pa.)
Plax Cornoration (Conn.)
Polaray Company (N.Y.)
Potter & Brumfield Mfg. Co., Inc (Indiana)
Precision Specialties (Calif.)
Prince Industrial Plastics Corp. (Ohio)
Product Engineering & Mfg. Corp (Illinois)
Products Mfg. Co. (Calif.)
Prolon Plastics (Mass.)
Pycolite Plastics Corporation (N.Y.
R. & C. Plastic Products (R.I.)
Radio Corporation of America (N.Y.
Rainbow Plastic Ltd. (Ont., Can.)
Ranger-Tennere, Inc. (N.Y.)
Rathbun Molding Corp. (N.Y.)
Reyam Plastic Products Co. (Ill.)
Raymond Laboratories, Inc. (Minn.
Recto Molded Products, Inc. (Ohio
Reinhold, F. E. Mfr. (Calif.)
Reinhold-Geiger Plastics (Calif.)
Remler Company, Ltd. (Calif.)
Republic Plastics Corp. (Ill.)
Resistoflex Corporation (N.J.)
Reynolds Spring Co. (Ohio)
Richardson Company (Ill.)
Rickenbacher Mfg. Co. (Calif.)
Ritter Company, Inc. (N.Y.)
Robb, Jos. & Company Limited (Que., Can.)
Rogan Bros. (Ill.)
Roger Mfg. Co. (Calif.)
Rogers, V. F. (Colo.)
Royal Moulding Company (R.I.)
Scott, Geo. S. Mfg. Co. (Conn.)
Seder & Son Molded Products Com pany (Colorado)
Shaw Insulator Company (N.J.)
Sheller Manufacturing Corporation (Ind.)
Silex Company, The (Conn.)
Simplicity Tool Co. (Ore.)
Slater, N. G. Corp. (N.Y.)
Smith & Stone Ltd. (Ont., Can.)
Snow Plastics Corporation (Ill.)
Solar Plastics Co. (Ill.)
South Bend Modern Molding Co. (Indiana)
Southern Plastics Company (S.C.)
Southwest Machine & Plastic Co., (California)
Specialty Insulation Mfg. Co. (N.Y.)
Sport Products, Inc. (Ohio)
Square 'D' Co. (Ind.)
Standard Cap & Molding Co., Inc. (Maryland)
Standard Plastics (Calif.)
Standard Plastics Company (Mass.)
Standard Plastic Industries (Ill.)
Stimson 'AGA' Plastics (Ill.)

[Bold face listings indicate companies who manufacture their own molds and dies.]

[MOLDERS, COMPRESSION] Cont.

nson Reflector Co. (Ill.)
es, Joseph Rubber Co. (N.J.)
es, Josepb Rubber Co., Ltd. Ont., Can.)
ak Manufacturing Co. (Wash.)
erior Plastics Co. (Calif.)
thetic Plastics Sales Co.. (N.Y.)
hetic Plastics Co. (N.J.)
cuse Ornamental Co. Inc. (N.Y.)
lor Manufacturing Company Wis.)
Die Cast & Molded Products California)
nical Plastics Laboratories Calif.)
ex, Inc. (Minn.)
kelsen Machine Company (Mass.)
loid Products Co. (Mass.)
r Electric & Machine Works Ill.)
n Plastics Products Co. (Calif.)
ns-Matic Plastics Co. (Ill.)
nton Plastic & Metals Co. (N.J.)
-Plastics (Calif.)
- United Plastics Corp. (N.J.)
gsten Contact Mfg. Co., Inc. N.J.)
ion Insulating Co., Inc. (W.Va.)
ted Plastic & Tool Works (Calif.)
ted Plastics Corporation (Obio)
ted States Stoneware Co., The Ohio)
versal Button Fastening & Button Co. (Mich.)
versal Plastics Corporation (N.J.)
n Norman Molding Co. (Ill.)
hek Tool Company, The (Ohio)
tor Metal Products Corp. (N.Y.)
tory Plastics Co. (Mass.)
& A. Company (Mass.)
ahl Clipper Corp. (Ill.)
alter, John & Sons Limited Ontario, Canada)
rren Plastics Corporation (Pa.)
shington Molding Co., Inc (N.Y.)
eatherhead Co. (Ohio)
terbury Companies, Inc. (Conn.)
tertown Manufacturing Company Conn.)
yne Plastic Products (Ind.)
eaver, J. P. & Co. (Calif.)
erner Mfg. Co. (Ill.)
esco Products (Calif.)
estern Plastics, Inc. (Calif.)
estern Plastic Molding Co. (Calif.)
heeling Stamping Company W.Va.)
hite, S. S. Dental Mfg. Co. N.Y.)
hite, Thos. J. Plastics Co. (Mo.)
ilcox Plastics Molding Co. (Calif.)
indman Brothers (Calif.)
inner Mfg., Inc (N.J.)
irz, A. H., Inc. (Pa.)
oodruff Company, The (N.Y.)
ardley Plastics Company (Ohio)
ollinger, Albert (Ill.)

RAW

eaman Molded Products Co. (Ore.)
orkland Laboratories (Ind.)
aramount Plastics Co., Inc. (Ill.)
othco Products (Pa.)

XTRUSION

bar Plastics Company (Pa.)
cadia Synthetic Products
Div. Western Felt Works (Ill.)
merican Extruded Products Co. (Calif.)
merican Hard Rubber Company (N.Y.)
merican Molding Co. (Calif.)
merican Products Mfg. Co. (La.)
mity Plastics Co., Inc. (N.Y.)
nchor Plastics Co. (N.Y.)
uburn Button Works, Inc. (N.Y.)
eck I. & Sons, Inc. (N.Y.)
elden Manufacturing Co. (Ill.)
erkander, George F., Inc. (R.I.)
lum, Julius & Co., Inc. (N.Y.)
rand, William & Company (N.Y.)
uchsbaum, S. & Co. (Ill.)
amp Plastics Corp. (N.J.)
anadian Button, Ltd. (Que., Can.)
arter Products Corporation (Ohio)
elluplastic Corporation (N.J.)
hicago Extruded Plastics (Ill.)
olt's Patent Fire Arms Mfg. Co. (Connecticut)
olumbia Engineering Co., Inc. (New Jersey)
ommercial Plastics Co. (Ill.)
ommonwealth Plastic Co. (Mass.)
ontinental Can Co., Inc. (Obio)
oy Mfg. Co. (Mich.)
avis, Joseph Plastics Co. (N.J.)
etroit Macoid Corporation (Mich.)
ie-Plast Co. Ltd. (Que., Can.)
ominion Rubber Co. Ltd. (Ontario, Canada)
rell Novelty Mfg. Co., The (N.Y.)
uplate Canada Ltd. (Ont., Can.)
clipse Moulded Products Co. (Wis.)
lectroforming Company (Wis.)
rie Resistor Corporation (Pa.)
ureka Pearl Works (N.J.)
velo Mfg. Co. (N.J.)

[MOLDERS, EXTRUSION] Cont.

Extruded Plastics, Inc. (Conn.)
Firestone Industrial Products Co. (Ohio)
Foster Grant Co., Inc. (Mass.)
Gemloid Corporation (N.Y.)
General Electric Co., Plastics Div. (Mass.)
General Plastics Ltd. (Ont., Can.)
Gesler Jeweiry Co. (R.I.)
Goodrich, B. F. Company, (Ohio)
Great American Plastics Co. (Mass.)
Greening Wire Co., Ltd., The (Ont., Can.)
Hopp Press, Inc., The (N.Y.)
Hungerford Research Corp. (N.J.)
Huntington Stamping & Plastic Co., Inc. (West Virginia)
Hyde, A. L. (N.J.)
Inceloid Co., Inc. (La.)
Industrial Plastics Corp. (Wis.)
Industrial Specialties, Inc. (N.Y.)
Industrial Synthetics Corp. (N.J.)
Ingwersen Manufacturing Co., Inc. (Colo.)
Inland Manufacturing Div., General Motor Corp. (Ohio)
Irvington Varnish & Insulator Co. (N.J.)
Irwin Corporation (N.Y.)
Jay Novelty Co. (N.Y.)
Kenneth, Donald Co., The (Calif.)
Kingman, E. B. Co. (N.Y.)
La Pointe-Plascomold Corp. (Conn.)
Linsky, M. A. Co. (Calif.)
Mack Molding Co. (N.J.)
Magnetic Plastics Co. (Ohio)
Marsb Wall Products, Inc. (Obio)
Midwest Plastic Products Co. (Ill.)
Mills, Elmer E. Corporation (Ill.)
Mitchell Button Co. Ltd, (Ont., Can.)
Molding Corporation of America, Inc. (Rhode Island)
Morrell, George Corp. (Micb.)
National Plastic Prod. Co. (Md.)
National Varnished Products Corporation, The (New Jersey)
Northwest Plastics, Inc. (Minn.)
Ontario Steel Products Company Limited (Ontario, Canada)
Owens-Illinois Glass Co. (Ohio)
Pan American Mfg. Co. (Calif.)
Pantasote Company, The (N.J.)
Paramount Rubber Co. (Mich.)
Parker Appliance Company, The (Ohio)
Phoenix Plastics Corp. (Mass.)
Place, Roland P. Company (Micb.)
Plastex Corporation (Ohio)
Plastic Process Company (Calif.)
Plastic Products, Inc. (N.Y.)
Plax Corporation (Conn.)
Precision Specialties (Calif.)
Prince Industrial Plastics Corp. (Ohio)
Prolon Plastics (Mass.)
Resin Industries (Calif.)
Resistoflex Corporation (N.J.)
Revere Copper & Brass, Inc. (Ill.)
Rex Co., Inc., The (Mass.)
Reynolds Spring Co. (Ohio)
Robb, Jos. & Company Limited (Que., Can.)
Rolling & Engraving Mills Co., Inc. (Illinois)
Ronci, F. Co. (R.I.)
St. Louis Plastic Moulding Co. (Mo.)
Sandee Manufacturing Co. (Ill.)
Schwanda, B. & Sons (N.Y.)
Shaw Insulator Company (N.J.)
Southern Plastics Company (S.C.)
Standard Cap & Molding Co., Inc. (Maryland)
Standard Products Co., Tbe (Mich.)
Streamline Plastics Company (N.Y.)
Superior Plastic Company (Ill.)
Superior Plastics Co. (Calif.)
Supply Mfg. Co., Inc. (N.Y.)
Surprenant Electrical Insulation Co. (Mass.)
Synthetic Plastics Co. (N.J.)
Technical Plastics Co. (Ohio)
Teckna Company (N.Y.)
T-Die Cast & Molded Products (California)
Tray-Ware, Inc. (Ohio)
United States Stoneware Co., Tbe (Ohio)
V & M Mfg. Co. (Pa.)
Victory Plastics Co. (Mass.)
Visking Corporation, The (Ill.)
Walter, John & Sons Limited (Ontario, Canada)
Werner, R. D. Co., Inc. (N.Y.)
Wesco Products (Calif.)
Western Plastics, Inc. (Calif.)
White, S. S. Dental Mfg. Co. (N.Y.)
Whitehead Metal Prod., Co. (N.Y.)
Whiteford Plastics Co., Inc. (N.Y.)
Yardley Plastics Company (Ohio)
Zinglass Products Co. of America (New York)

INJECTION

Abar Plastics Company (Pa.)
Ace-Hy Plastic Co. (N.Y.)
Adams Plastic Products (Ohio)
Advance Molding Corp. (N.Y.)
All Metal Screw Products (N.Y)

[MOLDERS, INJECTION] Cont.

All Plastics, Inc. (N.J.)
Allied Plastics Corporation (Calif.)
Amatoy Corporation (Ill.)
American Extruded Products Co. (Calif.)
American Hard Rubber Co. (N.Y.)
American Insulator Corp. (Pa.)
American Molded Products Co. (Ill.)
American Molding Co. (Calif.)
American Plastics Engineering Corp. (Michigan)
American Plastic Mfg. Co. (Ill.)
American Specialties Mfg. Co. (California)
Amity Plastics Co., Inc. (N.Y.)
Amos Engineering Co. (Ill.)
Amos Molded Plastics (Ind.)
Anfinsen Plastic Molding (Ill.)
Arco Metalcraft, Inc. (N.Y.)
Ardee Plastics Company, Inc. (N.Y.)
Armstrong Cork Company (Pa.)
Arpin Products, Incorporated (N.J.)
Arrow Plastics Co. (N.J.)
Art Plastics Co. (Calif.)
Art Plastics Mfg. Co. (Calif.)
Artcraft Plastics, Inc. (Minn.)
Associated Specialties Corp. (R.I.)
Astor-Ramel Mfg. Co. (N.Y.)
Athol Comb Co. (N.Y.)
Atlantic Plastics, Inc. (N.Y.)
Auburn Button Works, Inc. (N.Y.)
Automatic Plastic Molding Company (Calif.)
Axel Plastic Button Co. (N.Y.)
B W Photo Utilities (Calif.)
Bacbmann Bros., Inc. (Pa.)
Barnes, Ralph Moulded Plastics (California)
Bauman & Bluzat (Ill.)
Beacon Industrial Engineering Service (New York)
Bel-Air Creations (Calif.)
Ben-Art Novelty Co., Inc. (N.Y.)
Berkander, George F., Inc. (R.I.)
Berkeley Engineering & Manufacturing Company (N.J.)
Bolta Company, The (Mass.)
Bolta Plastics Ltd. (Quebec, Can.)
Boonton Molding Co. (N.J.)
Braudenburg, Melford F. (N.Y.)
Breyer Molding Co. (Ill.)
Bridgeport Moulded Products, Inc. (Conn.)
Brier Manufacturing Company (R.I.)
Bright Star Battery Co. (N.J.)
Brilhart, Arnold Ltd. (N.Y.)
Broder Industries, Inc. (N.Y.)
Bryant Electric Company, The (Conn.)
Butterfield, T. F., Inc. (Conn.)
Caldwell Products, Inc. (N.Y.)
Cal-Pacific Co. (Calif.)
Camp Plastics Corp. (N.J.)
Canadian General Electric Company (Ontario, Canada)
Canadian General Rubber Co. Ltd. (Ontario, Canada)
Canadian Lapin Products Limited (Ontario, Canada)
Celluplastic Corporation (N.J.)
Central Die Casting & Mfg. Co., Inc. (Illinois)
Central Engineering & Plastic Co. (Ohio)
Chicago Die Mold Corp. (Ill.)
Chicago Molded Products Corporation (Illinois)
Church, C. F. Mfg. Co. (Mass.)
Cincinnati Advertising Products Co., The (Ohio)
Claremould Plastics Company (N.J.)
Clinford Corporation (N.J.)
Cluthe, Geo. Mfg. Co., Limited (Ontario, Canada)
Colt's Patent Fire Arms Mfg. Co. (Connecticut)
Columbia Engineering Co., Inc. (New Jersey)
Columbia Protektosite Co., Inc. (New Jersey)
Columbus Plastic Products, Inc. (O.)
Commercial Plastics Co. (Ill.)
Commonwealth Plastic Co. (Mass.)
Connecticut Plastic Products Co., Inc. (Connecticut)
Consolidated Molded Products Corp. (Pennsylvania)
Continental Can Co., Inc. (Ohio)
Continental Plastics Corp. (Ill.)
Corbin Engineering & Sales Co. (California)
Craven & Whittaker Company (R.I.)
Crown Fastener Corp. (R.I.)
Cruver Manufacturing Co. (Ill.)
C-Thru Ruler Company (Conn.)
Cuker Process Company (N.Y.)
D & P Molded Products Co. (Calif.)
Dandy Plastic Products Co., Inc. (N.Y.)
Davis, Joseph Plastics Co. (N.J.)
Delev Plastics Limited (Que., Can.)
Detroit Development and Mfg. Co., Inc. (Michigan)
Detroit Macoid Corporation (Mich.)
Detroit Molded Plastic Corp. (Mich.)
Diadem, Inc. (Mass.)
Die-Plast Co., Ltd. (Que., Can.)

[MOLDERS, INJECTION] Cont.

Dillon-Beck Manufacturing Co. (New Jersey)
Drell Novelty Mfg. Co., The (N.Y.)
Duall Molding Corp. (N.Y.)
Dulev Plastics (Ont., Can.)
Dominion Comb & Novelty Co., The (Que., Can.)
Du Page Plastics Co. (Ill.)
Duplate Canada Ltd. (Ont., Can.)
Eclipse Moulded Products Co. (Wis.)
Electric Auto-Lite Corp. (Mich.)
Electroforming Company (Wis.)
Electronic Mechanics, Inc. (N.J.)
Emleco Photo Accessories & Engineering Co. (California)
Emeloid Co., Inc., The (N.J.)
Erie Plastics Co. (Pa.)
Erie Resistor Corporation (Pa.)
Essex Corporation (Va.)
Evans, Luther J. (Ill.)
Evans-Winter-Hebb, Inc. (Mich.)
Eureka Pearl Works (N.J.)
Eveready Hdwe. Mfg. Co., Inc. (New York)
Federal Tool Cornoration (Ill.)
Felsenthal, G. & Sons (Ill.)
Firestone Industrial Products Co. (Ohio)
French Ivory Products Limited, The (Ontario, Canada)
Foster Grant Co., Inc. (Mass.)
Franklin Plastics Division Robinson Industries, Inc. (Pa.)
Fuller Brush Company (Conn.)
Gebhard, Harry W. (Ill.)
Gem Plastic Co. (N.Y.)
Gemloid Corporation (N.Y.)
General Electric Co., Plastics Div. (Mass.)
General Industries Company, The (Ohio)
General Plastic Products (Mich.)
Gerber Plastic Company (Mo.)
Gesler Jewelry Co. (R.I.)
Gits Molding Corp. (Ill.)
Gleich, Emanuel D. (N.Y.)
Globe Imperial Corp. (Ill.)
Goodrich, B. F. Company, The (Ohio)
Goodyear Footwear Corporation (R.I.)
Gray & Co. (Calif.)
Great American Plastics Co. (Mass.)
Grigoleit Company, The (Ill.)
Grotelite Co., Inc., The (Ky.)
Guarantee Neon Co. (Calif.)
Harco Corporation (Calif.)
Haro Products, Inc. (N.Y.)
Hermant, Percy Limited (Ont., Can.)
Hoosier Cardinal Corporation (Ind.)
Hopp Press, Inc., The (N.Y.)
Hungerford Research Corp. (N.J.)
Huntington Stamping & Plastic Co., Inc. (West Virginia)
Hyde, A. L. (N.J.)
Ideal Plastics Corporation (N.Y.)
Industrial Plastics Corp. (Wis.)
Industrial Rubber Goods Co. (Mich.)
Ingersoll Plastics Company (N.J.)
Ingwersen Manufacturing Co., Inc. (Colo.)
Injection Molding Co. (Mo.)
Injection Molding Corp. (N.Y.)
Inland Manufacturing Div., General Motors Corp. (Ohio)
Insulation Mfg. Co., Inc. (N.Y.)
Inter-Mountain Plastics Inc. (Utah)
International Molded Plastics (Ohio)
Irwin Corporation (N.Y.)
Jamison, H. (N.Y.)
Kampa Manufacturing Co. (Wis.)
Kasin, V. A. Molded Products (California)
Kayson Mfg. Co., Inc. (N.Y.)
Keeler Brass Co. (Mich.)
Kenneth, Donald Co., The (Calif.)
Keolyn Plastics (Ill.)
Kilgore Mfg. Company, The (Ohio)
Kingman, E. B. Co. (N.Y.)
Kirk, F. J. Molding Co. (Mass.)
Knoedler, Alphonse & Co. (Pa.)
Koller Craft Plastic Products, Inc. (Missouri)
Kuhn & Jacob Molding & Tool Co. (New Jersey)
Lakone Company, The (Ill.)
Lichten, Maurice A. Company (N.J.)
Lindenhurst Mfg. Co., Inc. (N.Y.)
Livingston Plastics Corp. (Ill.)
Loyal Manufacturing Co. (Texas)
Lynn Sign Co. (Mass.)
McDonald Manufacturing Co. (California)
MacDonald Mfg. Company (Mich.)
Mack, John & Son Molded Products (Illinois)
Mack Molding Co. (N.J.)
Magnetic Plastics Co. (Ohio)
Maico Co.. Inc., The (Minn.)
Majestic Molded Products, Inc. (N.Y.)
Maple Leaf Plastics Limited (Ont., Can.)
Master Plastic Molding Corp. (Mo.)
Mechanical Institute (N.J.)
Michigan Molded Plastics (Mich.)
Mill-O-Plast (N.Y.)

[Bold face listings indicate companies who manufacture their own molds and dies.]

[MOLDERS, INJECTION] Cont.

Mills, Elmer E. Corporation (Ill.)
Mine Safety Appliances Co. (Pa.)
Minneapolis Plastic Molders, Inc. (Minneapolis)
Minnesota Plastics Corp. (Minn.)
Modern Machine Co. (N.Y.)
Modern Plastics Corporation (Mich.)
Modglin Co. (Calif.)
Molded Insulation Company (Pa.)
Moulded Plastic Specialties Reg'd. (Quebec, Canada)
Molded Products Corp. (Ill.)
Monaplastics, Inc. (Conn.)
Monoplex Eye Division, American Optical Co. (Massachusetts)
Monroe Auto Equipment Co. (Mich.)
Multi-Products Tool Company (N.J.)
Na-Mac Products Corp. (Calif.)
National Fabricating Co. (N.Y.)
National Lock Company (Ill.)
National Plastic Prod., Co. (Md.)
National Plastics, Inc. (Tenn.)
National Tool & Manufacturing Co. (New Jersey)
Neo Plastics Products Company (New York)
New Plastic Corp. (Calif.)
Niagara Insul Bake Specialty Company (New York)
Nichols Plastic & Engineering Co. (California)
Northeastern Molding Co. (Conn.)
Northeastern Plastics (Mass.)
Northern Industrial Chemical Co. (Massachusetts)
Northwest Plastics, Inc. (Minn.)
Norton Laboratories, Inc. (N.Y.)
Nosco Plastics (Pa.)
Novelart Mfg. Co. (Calif.)
Nu-Dell Mfg. Co. (Ill.)
Ohio Plastic Co., The (Ohio)
Ontario Steel Products Company Limited (Ontario, Canada)
Owens-Illinois Glass Co. (Ohio)
Pacific Plastic & Mfg. Co. (Calif.)
Pan American Mfg. Co. (Calif.)
Paramount Plastics Mfg. Co. (Ill.)
Parker Appliance Company, (Ohio)
Patent Button Co. of Tenn., Inc., The (Tennessee)
Paulis Plastics Co. (Calif.)
Peerless Molded Plastics, Inc. (Ohio)
Pereles Bros., Inc. (Wis.)
Perfection Plasties Co. (Pa.)
Place, Roland P. Company (Mich.)
Plano Molding Company (Ill.)
Plastal Specialties Company (Wash.)
Plasteel (Calif.)
Plas-Tex Corporation, The (Calif.)
Plastex Corporation (Ohio)
Plastic Craft, Inc. (Minn.)
Plastic & Die Cast Products Corporation (California)
Plastic Die & Tool Corp. (Calif.)
Plastic Engineering Co. (R.I.)
Plastic Engineering, Inc. (Ohio)
Plastic Industries, Inc. (Ohio)
Plastics Injection Molders (N.J.)
Plastic Jewel Co. (N.Y.)
Plastic Manufacturers, Inc. (Conn.)
Plastic Molded Arts Co. (N.Y.)
Plastic Molded Products Co. (Ill.)
Plastics Molding Company (Mo.)
Plastic Molding Corp. (Conn.)
Plastic Products, Inc. (Conn.)
Plastic Research Foundation (Mass.)
Plastic and Rubber Products Company (California)
Plastic Specialties (Calif.)
Plastic-Ware, Inc. (N.Y.)
Plastic Wave Inc. (N.Y.)
Plasticraft Mfg. Co. (N.J.)
Plasticraft Specialties (Ill.)
Plastics, Inc. (Minn.)
Plasties Assooiates, Inc. (N.Y.)
Popular Plastic Products Corp. (New York)
Precision Molded Plastics Inc. (Ohio)
Precision Plastics Co. (Pa.)
Precision Products Co. (Wis.)
Presque Isle Plastics Inc. (Pa.)
Prince Industrial Plastics Corp. (Ohio)
Precision Molded Plastics, Inc. (Ohio)
Precision Specialties (Calif.)
Presco Plastics (Wis.)
Product Engineering & Mfg. Corp. (Illinois)
Prolon Plastics (Mass.)
Pyro Plastics Company (N.J.)
Quinn Berry Corp. (Pa.)
Radio Corporation of America (N.Y.)
Recto Molded Products, Inc. (Ohio)
Reliable Plastics Co. Limited (Ont., Can.)
Remler Company, Ltd. (Calif.)
Republic Plastics Corp. (Ill.)
Reynolds Spring Co. (Ohio)
Richardson Company (Ill.)
Robinson Industrial-Crafts, Ltd. (Ont., Can.)
Ronci, F. Co. (R.I.)
St. Louis Plastic Moulding Co. (Mo.)
Santay Corporation (Ill.)
Scott, Geo. S. Mfg. Co. (Conn.)
Scripto Manufacturing Co. (Ga.)

[MOLDERS, INJECTION] Cont.

Service Plastics, Inc. (Ill.)
Shaw Insulator Company (N.J.)
Sheller Manufacturing Corp. (Ind.)
Shepherd, J. H. Son & Co. (Ohio)
Sherr Manufacturing Co. (Calif.)
Simplicity Tool Co. (Ore.)
Sobenite, Inc. (Ind.)
Southern California Plastic Co. (Calif.)
Southern Plastics Company (S.C.)
Spir-it (Mass.)
Standard Molding Corp. (Ohio)
Standard Novelty Box Co. (N.Y.)
Standard Plastics Company (Mass.)
Standard Products Co., The (Mich.)
Stanton Brothers (Ill.)
Star Manufacturing Co. (Mass.)
Statler Manufacturing Co. (Ill.)
Sterling Injection Molding, Inc. (N.Y.)
Sterling Plastics Co. (N.J.)
Stimson 'AGA' Plastics (Ill.)
Stokes, Joseph Rubber Co. (N.J.)
Streamline Plastics Company (N.Y.)
Style Molders Co. (N.Y.)
Superior Plastic Co. (Ill.)
Superior Plastics Co. (Calif.)
T-Die Cast & Molded Products (California)
Tilton & Cook Co. (Mass.)
Timely Novelty Co. (N.Y.)
Titan Plastic Products Co. (Calif.)
Toledo Plastics Co. (Ohio)
Tri-State Plastic Molding Co. (Ky.)
Tri-United Plastics Corp. (N.J.)
Udylite Corporation, The (Mich.)
United Comb & Novelty Co. (Mass.)
United Plastic Co. (Mass.)
United Plastic & Tool Works (California)
Universal Plastics Corporation (N.J.)
Utah Plastic & Die-Cast Co., Inc. (Utah)
Valley Plastics, Inc. (Mass.)
Vermont Plastics, Inc. (Vt.)
Vern, Al Corp., The (Mich.)
Vichek Tool Company, The (Ohio)
Victor Metal Products Corp. (N.Y.)
Victory Button Co., Inc. (Mass.)
Victory Mfg. Company (Calif.)
Victory Manufacturing Co. (Ill.)
Victory Plastics Co. (Mass.)
Voges Manufacturing Company (N.Y.)
W. & A. Company (Mass.)
Walter, John & Sons Limited (Ontario, Canada)
Washburn Company (Mass.)
Waterbury Companies, Inc. (Conn.)
Watertown Manufacturing Company (Conn.)
Weatherhead Co. (Ohio)
Wecolite Company (N.Y.)
Werner Mfg. Co. (Ill.)
Western Plastics, Inc. (Calif.)
Westfield Mfg. Corp (Mich.)
Wesco Products (Calif.)
White, S. S Dental Mfg. Co. (N.Y.)
Whyte Manufacturing Company, Inc. (N.Y.)
Wilton Tool Co. (Calif.)
Wintrob, M. & Sons Limited (Ontario, Canada)
Worcester Moulded Plastics Co. (Mass.)
Yardley Plastics Company (Ohio)
Zollinger, Albert (Ill.)
Zenith Plastics Co. (Ohio)

JET

Cadillac Plastic Company (Mich.)
Chrysler Corporation (Mich.)
Columbia Engineering Co., Inc. (New Jersey)
Eastern Plastics, Inc. (Pa.)
Electric Auto-Lite Corp. (Mich.)
Evans-Winter-Hebb, Inc. (Mich.)
Hoover Company, The (Ohio)
Hydropack (Calif.)
Plastic Indnstries, Inc. (Ohio)
Plastic Processes, Inc. (Ohio)
Plastics Engineering Co. (Wis.)
Plastomatic Corporation (Pa.)
Prince Industrial Plastics Corp. (O.)
Standard Products Co., The (Mich.)

LOW PRESSURE

Airply Forming Company (Calif.)
Algerley Laboratories (Pa.)
Allied Aviation Corporation (Md.)
Amatoy Corporation (Ill.)
American Flower Works (Calif.)
Andover Kent Aviation Corporation (N.J.)
Art Plastic Company (N.Y.)
Arvey Corporation (Ill.)
Atlas Moulded Products Corp. (New York)
Atlas Plastic Industries (Md.)
Axel Plastic Button Company (N.Y.)
Barwood Products Co., Inc. (Ill.)
Beaman Molded Prod. Co. (Ore.)
Berst-Foster-Dixfield Co. (N.Y.)
Brilhart, Arnold Ltd. (N.Y.)
Buchsbaum, S. & Co. (Ill.)
Burton-Rodgers, Inc. (Ohio)

[MOLDERS, LOW PRESSURE] Cont.

Cadillac Plastic Company (Mich.)
California Plastics Products Corp. (California)
Campbell, J. Hugh Co. (Texas)
Canadian General Rubber Co. Ltd. (Ontario, Canada)
Cellulose Products Company (Calif.)
Cofax Corporation, Tbe (N.Y.)
Columbia Engineering Co., Inc. (New Jersey)
Commonwealth Products Co. (Pa.)
Compression Molding Company of St. Louis (Mo.)
Crosley Marine (Fla.)
Cunningham, W. W. Co. (Kan.)
Chrysler Corp. (Mich.)
Damascus Furniture Corp. (Va.)
Darco Plastics Co. (Mass.)
Dawson Company (Ohio)
Design Center, Inc. (N.Y.)
Die-Plast Co. Ltd. (Que., Can.)
Doane Products Corporation (Conn.)
Duplate Canada, Ltd. (Ont., Can.)
Duralyt, Inc. (Pa.)
Duramold Div., Fairchild Engine & Airplane Corp. (New York)
Eastern Plastics, Inc. (Pa.)
Eclipse Moulded Products Co. (Wis.)
Eldorado Mfg. Co. (Calif.)
Enka Plastic Company (Calif.)
Fabricon Products, Inc. (Mich.)
Farley & Loetscher Mfg. Co. (Iowa)
Felsenthal, G. & Sons (Ill.)
Garfield Mfg. Co. (N.J.)
General Electric Co., Plastics Div. (Massachusetts)
General Plastics Corporation (Ind.)
General Plastics Mfg. Co. (Wash.)
General Plastic Products (Mich.)
General Textile Mills, Inc. (N.Y.)
Genii Corporation, The (Ohio)
Greggory, Inc. (Ill.)
Haro Products, Inc. (N.Y.)
Haskelite Manufacturing Corporation (Mich.)
Hawley Products Company (Ill.)
Heath Company (Mich.)
Hexco Products, Inc. (Ill.)
HR Engineering Company (Ind.)
Hydroproducts Corporation (N.Y.)
Illini Molded Plastics (Ill.)
Industrial Plastics Corp. (Calif.)
Industrial Plastics Corp. (Wis.)
Keller Products (N.H.)
Kerr, R. W. Co. (Nebr.)
King Plastics Corp. (Colo.)
K-Plastix (Calif.)
Lifetime Plastic Inc. (Colo.)
Lone Star Plastics Company (Texas)
Long Island Engraving Co. (N.Y.)
Lyon Metal Products, Inc. (Ill.)
Marco Chemicals, Inc. (N.J.)
Marine Air Research (Conn.)
Microloid Co. (Pa.)
Mine Safety Appliances Company (Pa.)
Monoplex Eye Division American Optical Co. (Mass.)
Montrose Paper Mills (Ill.)
Moulded Plastic Specialties Reg'd. (Quebec, Canada)
National Research & Mfg. Co. (California)
New Plastic Corporation (Calif.)
Owens-Corning Fiberglas Corp. (O.)
Paramount Rubber Co. (Mich.)
Passer Plastics Co. (Calif.)
Permochart Company, The (Pa.)
Presco Plastics (Wis.)
Plastic Industries (N.Y.)
Plastic Fabricators Company (Calif.)
Plastic Film Corporation (N.Y.)
Plastic Laminating Co. (Calif.)
Plastic Papers Co. (Ill.)
Plastic Plywood Products Co. (Ark.)
Plastics, Inc. (Minn.)
Plastic Supply Company (Ont., Can.)
Plastomatic Corporation (Pa.)
Polyplastex (N.Y.)
Precision Electrotype Co. (Calif.)
Radio Corporation of America (N.Y.)
Rainbow Plastic Ltd. (Ont., Can.)
Rand Rubber Company (N.Y.)
Ranger-Tennere, Inc. (N.Y.)
RPM Company The (Colo.)
Schneider, Eugene S., Plastics (Calif.)
Shellmar Products Co. (Ohio)
Snedaker, Frank C. & Co., Inc. (Pa.)
Sport Products, Inc. (Ohio)
Stack Plastics Co. (Calif.)
Stanley Mfg. Co. Limited (Ont., Can.)
Swedlow Plastics Co. (Calif.)
Taylor Fibre Company (Pa.)
Tensolite Corporation (N.Y.)
Tray-Ware, Inc. (Ohio)
United Pressed Products Co. (Ill.)
U. S. Plywood Corporation (N.Y.)
United States Rubber Co. (Ind.) Footwear Division
Vidal Research Corp. (N.J.)
Virginia Plak Company (N.Y.)
Walter, John & Sons Ltd. (Ontario, Canada)
Wesco Products (Calif.)
Western Plastics, Inc. (Calif.)

[MOLDERS, LOW PRESSURE] Cont

Western Plastics Ltd. (B.C., Can.)
Western Products Inc. (Ohio)
White, Thos. J. Plastics Co. (Mo.)
Whiteford Plastics Co., Inc. (N.Y.)
Wills & Roberts Plastics Mfg. Corp (California)
Winner Mfg. Co., Inc. (N.J.)
Woodall Industries, Inc. (Mich.)
Zippy Corporation (Wash.)

RESIN FIBRE

American Brakeblok Division, American Brake Shoe Co. (Michigan)
American Flower Works (Calif.)
Borkland Laboratories (Ind.)
Burton-Rodgers, Inc. (Ohio)
Chemical Plastics, Inc. (Minn.)
Columbian Rope Company (Mich.)
Compression Molding Company of St. Louis (Mo.)
Crosley Marine (Fla.)
Cunningham, W. W. Co. (Kan.)
D & P Molded Products Co. (Calif.
Dow Chemical Company (Mich.)
Eastern Plastics, Inc. (Pa.)
Eclipse Moulded Products Co. (Wis.)
General Plastic Products (Mich.)
Genii Corporation, The (Ohio)
Gillette Fibre Company (Mass.)
Hawley Products Company (Ill.)
Industrial Plastics Corp. (Wis.)
Keyes Fibre Company (Me.)
Lifetime Plastic Inc. (Colo.)
Lone Star Plastics Company (Texa
Lyon Metal Products, Inc. (Ill.)
Marathon Corporation (Wis.)
National Research & Mfg. Co. (California)
Radio Corporation of America (N.Y.
United Pressed Products Co. (Ill.)
Vidal Research Corp. (N.J.)
Wills & Roberts Plastics Mfg. Corp (California)

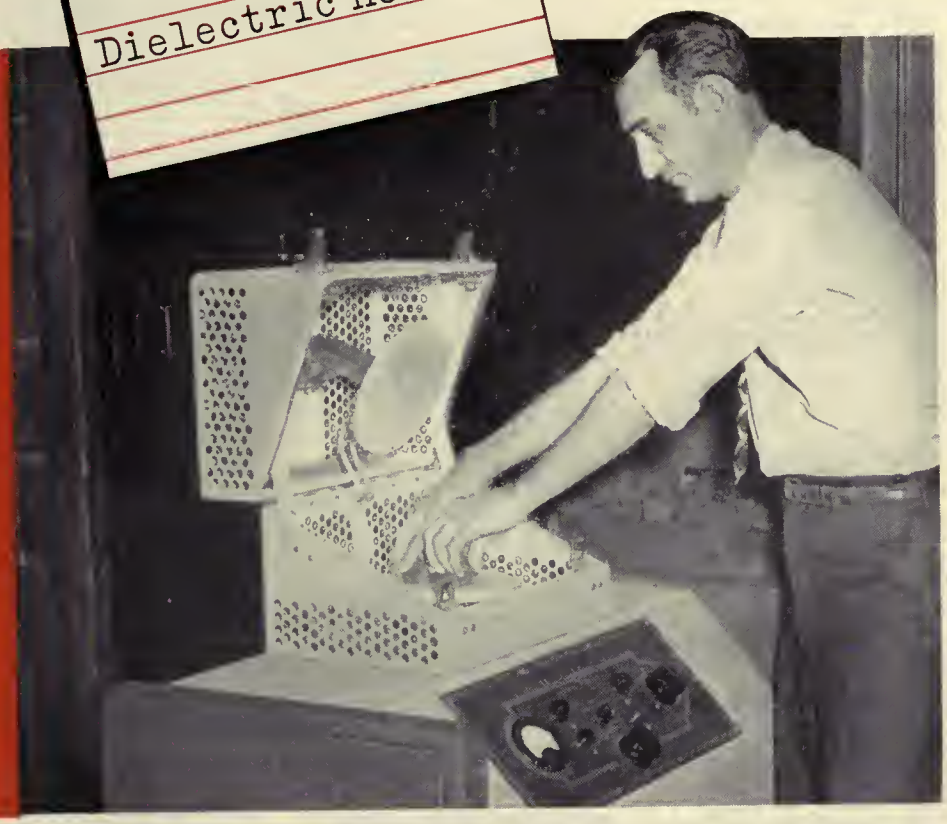
TRANSFER

Abar Plastics Company (Pa.)
Accurate Molding Corporation (N.Y.
Allanson Armature Mfg. Co. Ltd., The (Ontario, Canada)
All Metal Screw Product (N.Y.)
American Insulator Corp. (Pa.)
American Molding Co. (Calif.)
American Plastic Mfg. Co. (Ill.)
Automatic Plastic Molding Compa (Calif.)
Artcraft Plastics, Inc. (Minn.)
Auburn Button Works, Inc. (N.Y.)
Bangor Plastics, Inc. (Mich.)
Beacon Industrial Engineering Service (New York)
Berkeley Engineering & Manufacturing Company (N.J.)
Boonton Molding Co. (N.J.)
Breyer Molding Co. (Ill.)
Brilhart, Arnold Ltd. (N.Y.)
Broder Industries, Inc. (N.Y.)
Butterfield, T. F., Inc. (Conn.)
C. M. Plastic Molding Co. (N.J.)
California Pacific Plastic Co. (Calif
California Plastic Moulding Co. (California)
California Plastics Div., E. D. Bullard Co. (California)
Canadian General Electric Company (Ontario, Canada)
Chicago Plastic Mfg. Co. (Ill.)
Church, C. F. Mfg. Co. (Mass.)
Cinch Manufacturing (Ill.)
Cincinnati Advertising Products Co., The (Ohio)
Columbia Engineering Co. (N.J.)
Commercial Plastics Co. (Ill.)
Compression Molding Company of St. Louis (Mo.)
Connecticut Hard Rubber Company, The (Connecticut)
Consolidated Molded Products Corp. (Pennsylvania)
D & P Molded Products Co. (Calif.)
Dickten & Masch Mfg. Co. (Wis.)
Diemolding Corporation (N.Y.)
Dominion Plastics Limited (Que., Can.)
Dominion Rubber Co. Ltd. (Ontario, Canada)
Duall Molding Corp. (N.Y.)
Du Page Metal Products (Ill.)
Eby, Hugh H. Inc. (Pa.)
Eastern Plastics, Inc. (Pa.)
Electronic Mechanics, Inc. (N.J.)
Emleco Photo Accessories & Engineering Co. (California)
Evans-Winter-Hebb, Inc. (Mich.)
General Electric Co., Plastics Div. (Mass.)
General Industries Company, The (Ohio)
General Products Corp. (N.Y.)
Genii Corporation, The (Ohio)
Gerber Plastic Company (Mo.)
Gits Molding Corp. (Ill.)
Gleich, Emanuel D. (N.Y.)
Grigoleit Company, The (Ill.)
Gullikensen, Wm. M. Mfg. Company (Mass.)
Haas Corporation, The (Mich.)

[Bold face listings indicate companies who manufacture their own molds and dies.]

The case for Dielectric Heating

Electronics hikes production 1/3 cuts mold size 4/5



When you can whittle the time cycle for molding thermosetting plastics by 36%, obtain a better product and reduce costs of all phases of the operation, you've gained an effective new tool for modern production. Here is a case study showing how you can improve your production.

Hot-water bottle stoppers molded by the new process were produced 1/3 faster with a mold only 4/5 of the size of the previously-used compression mold. Thread tolerances were maintained accurately.

So successful is this new system that one manufacturer using r.f. preheating saved more than 66% of his previous mold costs alone! The flexibility of dielectric preheating adapts it perfectly to many other operations, too . . . from making parts with long, slender holes to molding metal inserts into parts.

This exceptional versatility and effectiveness of dielectric heating is nothing new to plastics manufacturers familiar with the broad background of Westinghouse in helping develop radio frequency heating to new efficiency. Get all the facts today from your nearest Westinghouse office. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Penna.

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PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

Electronics at Work

[MOLDERS; TRANSFER] cont.
Howard Manufacturing Corp. (Iowa)
Illini Molded Plastics (Ill.)
Imperial Molded Products (Ill.)
Industrial Plastics Corp. (Wis.)
Inland Manufacturing Div., General Motors Corp. (Ohio)
International Molded Plastics (Ohio)
Irwin Engineering & Mfg. Co. (California)
Kellogg Switchboard & Supply Co. (Ill.)
Koller Craft Plastic Products, Inc. (Missouri)
Kuhn & Jacob Molding & Tool Co. (New Jersey)
Kurz-Kasch, Inc. (Ohio)
Mack, John & Son Molded Products (Illinois)
Mack Molding Co. (N.J.)
Maple Leaf Plastics Ltd. (Ont., Can.)
Martindell Molding Co. (N.J.)
Mayfair Molded Products Corp. (Ill.)
McDonald Mfg. Co. (Calif.)
Minneapolis Plastic Molders, Inc. (Minneapolis)
Modern Plastics Corporation (Mich.)
Moulded Plastic Specialties Reg'd. (Quebec, Canada)
Molnar, John E. (Mo.)
Monoplex Eye Division American Optical Co. (Mass.)
Multi-Products Tool Company (N.J.)
Mycalex Corporation of America (N.J.)
National Lock Company (Ill.)
National Plastics, Inc. (Tenn.)
National Tool & Manufacturing Company (N.J.)
New Plastic Corporation (Calif.)
Niagara Insul Bake Specialty Co. (New York)
Nichols Plastic & Engineering Co. (Calif.)
Northern Industrial Chemical Co. (Mass.)
Northwestern Plastics Co. (Ill.)
Northwest Plastics, Inc. (Minn.)
Norton Laboratories, Inc. (N.Y.)
Nu-Dell Mfg. Co. (Ill.)
Oris Mfg. Co., Inc. (Conn.)
Pacific Plastic Prod. Co. (Calif.)
Paramount Rubber Co. (Mich.)
Paulis Plastics Co. (Calif.)
Penn-Plastics Corporation (Pa.)
Plastic & Die Cast Products Corp. (California)
Plastic Manufacturers, Inc. (Conn.)
Plastic Mold Engineering Co. (Mich.)
Plastic Molding Corp. (Conn.)
Plastic Products, Inc. (Conn.)
Plastic Research Products Laboratories (Ohio)
Plastic and Rubber Products Company (Calif.)
Plastic Specialties (Calif.)
Plastics, Inc. (Minn.)
Plastics Molding Company, The (Mo.)
Plastomatic Corporation (Pa.)
Plastimold, Inc. (Mass.)
Practical Plastics, Inc. (Fla.)
Prince Industrial Plastics Corp. (Ohio)
Product Engineering & Mfg. Corp. (Illinois)
Prolon Plastics (Mass.)
Rainbow Plastic Ltd. (Ont., Can.)
Rathbun Molding Corp. (N.Y.)
Recto Molded Products, Inc. (Ohio)
Reinhold-Geiger Plastics (Calif.)
Remler Company, Ltd. (Calif.)
Richardson Company (Ill.)
Ritter Company, Inc. (N.Y.)
Rogers, V. F. (Colo.)
Scott, Geo. S. Mfg. Co. (Conn.)
Seder & Son Molded Products Company (Colo.)
Shaw Insulator Company (N.J.)
Smith & Stone Ltd. (Ont., Can.)
Solar Plastics Co. (Ill.)
Specialty Insulation Mfg. Co. (N.Y.)
Square 'D' Co. (Ind.)
Standard Plastic Industries (Ill.)
Standard Products Co., The (Mich.)
Stokes, Joseph Rubber Co. (N.J.)
Stokes, Joseph Rubber Co., Ltd. (Ont., Can.)
Taylor Manufacturing Co. (Wis.)
Union Insulating Company Inc. (W.Va.)
United Plastic & Tool Works (Calif.)
Viteor Metal Products Corp. (N.Y.)
Victory Plastics Co. (Mass.)
Warren Plastics Corporation (Pa.)
Waterbury Companies, Inc. (Conn.)
Watertown Manufacturing Company (Conn.)
Wayne Plastic Products (Ind.)
Weatherhead Co. (Ohio)
Werner Mfg. Co. (Ill.)
Wilcox Plastics Molding Co. (Calif.)
Zollinger, Albert (Ill.)

Plastics Materials

ALKYD RESINS

Alkydol Labs., Inc. (Ill.)
American Cyanamid & Chemical (New York)
American Resinous Chemicals Corp (Massachusetts)
Ansbacher-Siegle Corp (N.Y.)
Beacon Co., The (Mass.)
Carbogen Chemical Co. (N.J.)
du Pont, E. I. de Nemours & Co., Inc., Electrochemicals Dept. (Del.)
General Electric Co., Plastics Div., (Massachusetts)
Hercules Powder Co. (Del.)
Jones-Dabney Company (Ky.)
Lewis, J. D. Inc. (R.I.)
Monsanto Chemical Co., St. Louis Div. (Missouri)
Paramet Chemical Corp. (N.Y.)
Reichhold Chemicals, Inc. (Mich.)
Resinous Products & Chemical Co. (Pennsylvania)
Synvar Corporation (Del.)
U. S. Industrial Alcohol Co. (N.J.)

CAST RESINS

Allyl Esters

Goodrich, B. F. Chemical Co. (Ohio)
Marco Chemicals, Inc. (N.J.)
Pittsburgh Plate Glass Co. (Pa.)

Phenol formaldehyde

Bakelite Corporation (N.Y.)
Catalin Corporation (N.Y.)
Die-Plast Co. Ltd. (Que., Can.)
Durez Plastics & Chemicals, Inc. (New York)
Hull Iron & Steel Foundries, Ltd. (Quebec, Canada)
Knoedler Chemical Company (Pa.)
Marblette Corporation (N.Y.)

COLD MOLDED

Non-Refractory

American Hard Rubber Co. (N.Y.)
American Insulator Corp. (Pa.)
Garfield Mfg. Co. (N.J.)
General Electric Co., Plastic Div. (Massachusetts)

Refractory

American Insulator Corp. (Pa.)
Colt's Patent Fire Arms Mfg. Co. (Connecticut)
Garfield Mfg. Co. (N.J.)
General Electric Co., Plastics Div. (Massachusetts)

MOLDING BLANKS

Bakelite Corporation (N.Y.)
Canadian Bridge Engineer. Co. Ltd. (Ontario, Canada)
Columbian Rope Company (N.Y.)
General Electric Co., Plastics Div. (Massachuetts)
Rogers Corp. (Conn.)
Westinghouse Electric Corp. (Pa.)

MOLDING COMPOUNDS (also Sheet, Rod, Tube, Film)

(Note: Supplied only as liquid monomer, not in cast form.)

Acrylics

du Pont, E. I. de Nemours & Co., Inc., Plastics Div. (New Jersey)
Rohm & Haas Company (Pa.)

Aniline formaldehyde

Ciba Products Corp. (N.J.)

Casein

American Plastics Corp. (N.Y.)
Morrell, Geo. Corp. (Mich.)
Phoenix Plastics Corp. (Mass.)

Cellulose acetate

American Molding Powder & Chemical Corp. (New York)
Celanese Plastics Corp. (N.Y.)
Chemaco Corp. (N.J.)
du Pont, E. I. de Nemours & Co., Inc., Plastics Div. (New Jersey)
Gering Products, Inc. (N.J.)
Monsanto Chemical Co., Plastics Div. (Massachusetts)
Nixon Nitration Works (N.J.)
Synthetic Resins Ltd. (Ont., Can.)
Tenessee Eastman Corp. (Tenn.)
Westchester Chemical Corporation (New York)

Cellulose acetate butyrate

Tenessee Eastman Corp. (Tenn.)

Cellulose nitrate

Celanese Plastics Corp. (N.Y.)
du Pont, E. I. de Nemours & Co., Inc., Plastics Div (New Jersey)

[MATERIALS; MOLDING] cont.
Monstanto Chemical Company Plasties Div (Massachusetts)
Nixon Nitration Works (N.J.)

Cellulose propionate

Celanese Plastics Corp. (N.Y.)

Ethyl cellulose

Celanese Plastics Corp (N.J.)
Chemaco Corporation (N.J.)
Dow Chemical Company (Mich.)
Hercules Powder Co. (Del.)
Nixon Nitration Works (N.J.)
Synthetic Resins Ltd. (Ont., Can.)
Westchester Chemical Corp. (N.Y.)

Indene coumarone

Neville Company (Pa.)

Melamine formaldehyde

American Cyanamid Company (N.Y.)
Ciba Products Corp. (N.J.)
Monsanto Chemical Co., Plastics Div. (Massachusetts)
Plaskon Div., Libbey-Owens-Ford (Ohio)

Methyl methacrylate (see acrylics)

Nylon

du Pont, E. I. de Nemours & Co., Plastics Div. (New Jersey)

Phenol formaldehyde

Bakelite Corporation (N.Y.)
Colasta Company, Inc. (N.Y.)
Drackett Co., The (Ohio)
Durez Plastics & Chemicals, Inc. (New York)
Durite Plastics, Inc. (Pa.)
General Electric Company, Plastics Div. (Massachusetts)
Heresite & Chemical Co. (Wis.)
Interlake Chemical Corp. (Ohio)
Monsanto Chemical Co., Plastics Div. (Massachusetts)
Reilly Tar & Chemical Corp. (Ind.)
Synthetic Resins Ltd. (Ont., Can.)
Synvar Corporation (Del.)
Watertown Mfg. Co. (Conn.)
Westinghouse Electric Corp., Micarta Dept. (Pennsylvania)

Phenol furfural aldehyde

Durite Plastics, Inc. (Pa.)

Polyethylene

Bakelite Corp. (N.Y.)
du Pont, E. I. de Nemours & Co., Inc., Plastics Div. (New Jersey)

Polystyrene

Bakelite Corp. (N.Y.)
Catalin Corp. (N.Y.)
Chemaco Corp. (N.J.)
Dow Chemical Co. (Mich.)
Monsanto Chemical Co., Plastics Div. (Massachusetts)

Polyvinyl acetal

Shawinigan Products Corp. (N.Y.)

Polyvinyl butyral

Bakelite Corporation (N.Y.)
de Pont, E. I. Nemours & Co., Inc., Plastics Div. (New Jersey)
Monsanto Chemical Co., Plastics Div. (Massachusetts)

Polyvinyl chloride

Goodrich, B. F. Chemical Co. (Ohio)

Polyvinyl formal

Monsanto Chemical Co., Plastics Div. (Massachusetts)

Urea formaldehyde

American Cyanamid Company (N.Y.)
Bakelite Corp (N.Y.)
Ciba Products Corp. (N.J.)
Interlake Chemical Corp. (Ohio)
Plaskon Div., Libbey-Owens-Ford (Ohio)
Sylvan Plastics, Inc. (N.Y.)

Vinyl chloride acetate

Bakelite Corporation (N.Y.)
Chemaco Corporation (N.J.)
Coy Mfg. Co. (Mich.)

Vinylidene chloride

Dow Chemical Co. (Mich.)

Plywood Facing

Consolidated Water Power & Paper Company (Wisconsin)
Kimberly-Clark Corp. (Wis.)
Riegel Paper Corp. (N.Y.)

Plywood Molding

Allied Aviation Corporation (Md.)
Compression Molding Company of St. Louis (Mo.)
Duramold Div., Fairchild Engine & Airplane Corp (New York)
Fibremold, Inc. (Mass.)
Frisch Corporation (Ill.)
General Plywood Corporation (Ky.)
Haskelite Mfg. Corp. (Mich.)
Heath Company (Mich.)
Industrial Design Associates of Hollywood, (California)
Keller Products (N.H.)
Marshall, William L. Ltd. (N.Y.)
Microloid Co. (Pa.)
Plastic Plywood Products Co. (Ark.)
Plymold Corporation (Mass.)

[PLYWOOD MOLDING] cont.
Radolite Mfg. Co. (Miss.)
United Pressed Products Co. (Ill.)
U. S. Plywood Corporation (N.Y.)
Vidal Research Corp. (N.J.)
Wasbingfon Veneer Co. (Wasb.)
Winner Mfg. Co., Inc. (N.J.)

Plywood, Resin Bonded

Allied Aviation Corporation (Md.)
Duramold Div., Fairchild Engine & Airplane Corp. (New York)
General Plywood Corporation (Ky.
Harbor Plywood Corp. (Wash.)
Haskelite Mfg. Corp. (Mich.)
Heath Company (Mich.)
Industrial Design Associates of Hollywood (California)
Keller Products (N.H.)
Premier Engineering Supplies, Ltd. (Ontario, Canada)
Price, M. B. Associates (N.Y.)
Radolite Mfg. Co. (Miss.)
Technical Ply-Woods (Ill.)
U. S. Plywood Corporation (N.Y.)
Vidal Research Corp. (N.J.)
Washington Veneer Co. (Wash.)

Scrap Dealers

Aceline Film Reclaiming Co. (N.Y
American Cellulose Co. (Ind.)
American Pyroxylin Co. (N.J.)
Bamberger, A. (N.Y.)
Dry and Company (Ill.)
General Textile Products Co. (N.Y.
Gering Products, Inc. (N.J.)
Hanover Rubber & Metal Co. (Md.
Homan, Louis J. (Ohio)
International Plastic Prod. (Calif.)
Kings Specialty Company (N.Y.)
Landan, B. Rubber Products (Ill.)
Meyer & Brown Corp. (N.Y.)
Mill-O-Plast (N.Y.)
Muehlstein, H. & Co., Inc. (N.Y.)
National Plastic Prod. Co. (Mich.)
Oppenheimer, Alan D., Inc. (N.Y.)
Plastofilm, Inc. (Ill.)
Progress Smelting & Refining Co. (Ontario, Canada)
Rayon Processing Co. of R.I. (R.I
Rotex Plastics Co., Inc. (N.J.)
S. & E. Trading Co. (N.J.)
Success Plastics Recovery Works (Indiana)
United Sales Service (Calif.)

Special Services

CARTRIDGE TAPPING

Tap-Cartridge, Inc. (Ohio)

CHROME PLATING OF MOLDS

Dover Industries, Inc. (Ill.)
Hartford Chrome Corp. (Conn.)
General Hard Chrome Co. (Ohio)
Industrial Hard Chromium Co. (New Jersey)
Nicholl Hard Chrome Service (Michigan)
Nutmeg Chrome Corp., The (Conn

COLOR PHOTOGRAPHY

House of Color, Inc. (N. Y.)

CONSULTANTS

Aircraft Parts Development Corp. (New Jersey)
Albion Laboratories (N.Y.)
Aleks, Vytant (Ill.)
Alexander, Jerome (N.Y.)
Allen, Elliot A. (Calif.)
American Plastics Engineering Corp. (Michigan)
Arens, Egmont (N.Y.)
Aries, Robert S. (Conn.)
Arnkurt Associate Engineers (N.Y.)
Associate Engineering Co. (Mich.)
Aten-Davis Developments (N.Y.)
Auerbach, Alfred Associates (N.Y.)
Axel Plastics (N.Y.)
Bach, Alfons Associates (N.Y.)
Bacon, Frederick S. Laboratories (Mass.)
Barsky & Strauss, Inc. (N.Y.)
Bartelt Engineering Service (Ill.)
Bartolucci-Waldheim (Ill.)
Bauman, Morton A. & Associates (Ohio)
Bernhard, Lucian (N.Y.)
Bjorksten Laboratories (Ill.)
Blessing, Gregory Associates (N.Y.)
Bonwitt, Dr. Gustave L. Laboratory (N.Y.)
Borkland Laboratories (Ind.)
Boulware Berry Associates (N.Y.)
Boyko, John (Mich.)
Brown, E. Norris (Mass.)
Bry, Paul (N.Y.)
Budlong, Robert D., Inc. (Ill.)

[Bold face listings indicate companies who manufacture their own molds and dies.]

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PHENOL-FORMALDEHYDES • UREA-FORMALDEHYDES • ACRYLATES and METHACRYLATES • STYRENES • HARD RUBBER • CASEINS • ETHYL-CELLULOSES CELLULOSE ACETATES • CELLULOSE ACETATE BUTYRATES • CELLULOSE NITRATES

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Manufacturers of Quality Controlled Finishing Materials

ROCHESTER, MICHIGAN

[SERVICES, CONSULTANT] Cont.

Bullock-Smith Associates (N.Y.)
Bushman, Edwin F. (Ill.)
Calva, J. B. & Co. (Minn.)
Castaing, C. K. (Calif.)
Clark, Victor Marion Co. (N.Y.)
Classic Studio (N.Y.)
Conley, Leonard B. (Texas)
Consolidated Management Consultants (New York)
Corner Simon Associates (N.Y.)
Cruze, Charles Associates (Calif.)
Darr, Harold W. Associates (Minn.)
Davidoff, Charles (N.Y.)
Davies, Helen & Associates (N.Y.)
De Bell, George W. (Conn.)
DeBell, John (Mass.)
DeBell & Richardson (Mass.)
Delano-White Plastics & Engineering Co. (Michigan)
Designers for Industry, Inc. (Ill.)
Designers for Industry, Inc. (Ohio)
Derham, Philip A. & Associates (Pa.)
Design Associates (N.Y.)
Design Laboratory (Fla.)
Deskey, Donald Assoc. (N.Y.)
de Swart, Jan (Calif.)
Deutsch, Maurice (N.Y.)
Devenco Incorporated (N.Y.)
Diamond, Freda (N.Y.)
Di Cyan & Brown (N.Y.)
Dockendorff, V. A. (Ill.)
Dunne, Liam (N.Y.)
Duramold Div., Fairchild Engine & Airplane Corp. (N.Y.)
Electrochemical Industries (Mass.)
Eppenstein, James F. & Assoc. (Ill.)
Erisman, A. C. (Pa.)
Esselen, Gustavus J., Inc. (Mass.)
Evans Chemeties, Inc. (N.Y.)
Florida Chemical Research, Inc. (New York)
Gallay, Dr. Wilfred (Ont., Can.)
Gast, George August (Ill.)
Gianninoto, Frank (N.Y.)
Gordon, J. M. (N.Y.)
Graham, Crowley & Associates, Inc. (Ill.)
Grant Research Laboratory (Ill.)
Haggstrom, Arthur C. (Ill.)
Harshberger, N. P. (Calif.)
Hart, William A. (Ill.)
HR Engineering Company (Ind.)
Hungerford Research Corp. (N.J.)
Industrial Conversions (N.Y.)
Industrial Plastics Corp. (Wis.)
Industrial Research & Engineering Co. (Pennsylvania)
Institute of Design (Ill.)
Intra-Therm Corporation (Iowa)
Jenett, Henry (N.J.)
Jensen, Gustav (N.Y.)
Jeter, G. Guy & Associates (Conn.)
Johnson-Cushing-Nevell (N.Y.
Johnson, Gerald C. Associates (N.Y.)
Juniper Tool Works (Calif.)
Karlstad, Andrew C. (Calif.)
Klingberg & Hester (Ill.)
Kohlick, Freda (N.Y.)
Kopplin, Karl (Mo.)
Korda Graphics (N.Y.)
Lamb, Tom Co., Inc. (N.Y.)
LaWall & Harrison (Pa.)
Ledig, H. A. (Pa.)
Lescaze, Wm. (N.Y.)
Levey, Harold A. Laboratories (La.)
Levin, Monte L. (N.Y.)
Liebes, Dorothy W. (Calif.)
Lippincott, J. Gordon & Co. (N.Y.)
Lithgow, James Company (Calif.)
Loewy, Raymond Associates (N.Y.)
MacAlister, Paul, Inc. (N.Y.)
Mangan & Eckland (Ill.)
Many, J. & Co. (N.Y.)
Martial & Scull (N.Y.)
Martin, Frank M. (Mass.)
Martin, Ray C. (N.J.)
Marx, Erich (Calif.)
Mast Development Company, Inc. (Iowa)
Maxwell, Curtis F. (Texas)
Maywald, Elmer C. (Ill.)
Mehrer, Ted (N.Y.)
Menard, Omer A. (N.Y.)
Minn. Mining & Mfg. Co. (Minn.)
Molding Associates (N.Y.)
Modern Plastics Engineering Co. (N.J.)
Moholy-Nagy, L. (Ill.)
Mueller, Ernest (N.J.)
Narcus, Harold (Mass.)
Nash, Ben (N.Y.)
Niclaus, William L. (N.J.)
Norton, Arthur J. (Wash.)
Nu-Engineering Company (Mich.)
Orcutt, Philip D. (Mass.)
Orthmann Lab., Inc. (Wis.)
Pearson, Frederick Z. (Ill.)
Pellegrin, E. D. Co. (Ill.)
Pittsburgh Testing Lab. (Pa.)
Plastic Design & Development Co. (Ohio)
Plastic Engineering Labs. (Calif.)
Plastic Research Laboratory (Calif.)
Plastics Mold Design (N.J.)
Plastics Promotions (N.Y.)
Plastics Corp. of American (Calif.)

[SERVICES, CONSULTANT] Cont.

Plastics Counsel and Development Laboratory (California)
Plastics Service Engineering (Mich.)
Plastics Training Center (Calif.)
Plasti-Glo Mfg. Co. (Ill.)
Plastite Adhesive Cement Co. (Ill.)
Plastiques Laboratories, The (Ill.)
Poliner, William (N.Y.)
Post & Johnson, Inc. (Conn.)
Product Engineering & Mfg. Corp. (Illinois)
Product Engineering & Tool Design Co. (New Jersey)
Productioneering Associates (Ill.)
Radio Frequency Labs., Inc. (N.J.)
Rae, J. Fraser (Calif.)
Reade, Martin G. (N.Y.)
Resinous Research Associates (N.Y.)
Richards, Harper (Ill.)
Rodier, Robert (N.Y.)
Rohde, Gilbert (N.Y.)
Rogers Chemical Company (Mich.)
Root, John W. (Ill.)
Sadtler, Samuel P. & Son, Inc. (Pa.)
Sakier, George (N.Y.)
Sanders, Morris (N.Y.)
Saslow, M. Robert (N.Y.)
Saxl Instrument Company (Mass.)
Scheele, Edwin H. (N.Y.)
Schepp, Wm. J. Co., Inc. (N.J.)
Schoneberger, A. W. (Ohio)
Schranz, F. G. (N.Y.)
Scientific Engr. & Plastic Research Co. (New York)
Scogland, C. A. (Ind.)
Simon, Lewis B. (N.Y.)
Simonds, Herbert R. (N.Y.)
Simonds, J. Earl (N.Y.)
Singmaster & Breyer (N.Y.)
Snell, Foster D., Inc. (N.Y.)
South Florida Test Service (Fla.)
Sowa Chemical Company (N.Y.)
Spence-Rigolo (N.Y.)
Sternson Labs., Ltd. (Ont., Can.)
Stevenson, Holland Newton Jr. (Calif.)
Stringfield, R. B. (Calif.)
Strothman, E. P. (Ill.)
Summon & Summon (N.Y.)
Surface Checking Gage Co. (Calif.)
Swibold, Duane (Mich.)
Technicraft Supply Co. (Mass.)
Thermo-Castic, Inc. (Calif.)
Thomas Engineering Co. (N.Y.)
Thomsen, J. Warren Associates (Ill.)
Tour, Sam & Co. (N.Y.)
Ullman, Morris Louis (Calif.)
Unified Laboratories (N.Y.)
Utleys (N.Y.)
Vassos, John (Conn.)
Vavrik, Louis (Ohio)
Versen, Kurt Company (N.J.)
Vidal Research Corp. (N.J.)
Vin-Sea Corporation (Ill.)
Wacker, George W. (Ohio)
Warner Tool Design Corp. (N.Y.)
Wein, Samuel (N.Y.)
Weiss, John M. and Co. (N.Y.)
Western Research Labs., Inc. (Calif.)
Wilkins, W. Burdette (N.J.)
Wilmet, Georges (N.Y.)
Winner, Lewis (N.Y.)
Wood, Dorothy M. & Walter W. (Calif.)
Wormley, Edward J. (N.Y.)
Yoh, H. L. Company (Pa.)
York Research Corporation (N.Y.)
Zenner, Justin (Ill.)

DESIGNERS

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Aids, Inc. (N.Y.)
Albion Laboratories (N.Y.)
Aleks, Vytant (Ill.)
Algoren, Lionel C. (Ill.)
Allen, Elliott A. (Calif.)
American Designers (Ill.)
American Designers Institute (Ill.)
American Plastics Engineering Corp. (Michigan)
Arens, Egmont (N.Y.)
Arlt, William H. (N.Y.)
Arnkurt Associate Engineers (N.Y.)
Aronson, Joseph, Inc. (N.Y.)
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Aten-Davis Developments (N.Y.)
Augenfeld, Felix, (N.Y.)
Bach, Alfons Associates (N.Y.)
Barnes & Reinecke (Ill.)
Bartelt Engineering Service (Ill.)
Bartolucci-Waldheim (Ill.)
Battalen, L. H. (N.Y.)
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Bauman, Morton A. & Associates (Ohio)
Bellantines Industrial Designers. (New York)
Bernhard, Lucian (N.Y.)
Boulware-Berry Associates (N.Y.)
Boyko, John (Mich.)
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Brown, E. Norris (Mass.)
Bry, Paul (N.Y.)
Budlong, Robert D., Inc. (Ill.)
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Castaing, C. K. (Calif.)

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Conant, Roger (N.Y.)
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Crescent Tool Co. (Ohio)
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Culton, W. Scott (Mass.)
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Dartnell, T. L. (N.Y.)
Darr, Harold W. Associates (Minn.)
Davies, Charles Associates (N.Y.)
Davies, Helen & Associates (N.Y.)
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Designers for Industry, Inc. (Ohio)
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de Swart, Jan (Calif.)
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Franke, Ann (N.Y.)
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Gianninoto, Frank (N.Y.)
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Lewis, A. Steven Associates (Ill.)
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Linder, Laural L. (Mass.)
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O'Neil, William (N.Y.)
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Paultin, Ethel P. (N.Y.)
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Plastic Design & Development Co. (Ohio)
Plastic Engineering Labs. (Calif.)
Plastic Wood Crafts (Ohio)
Plastiques Laboratories, The (Ill.)
Plastics Mold Design (N.J.)
Plastics Service Engineering (Mich.)
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Post & Johnson, Inc. (Conn.)
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Spuehler, E. A. (Ill.)
Stefe, Frank J. (Ill.)
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Stensgaard, W. L. & Assoc. (Ill.)
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Stevenson, Holland Newton Jr. (Calif.)
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Thomsen, J. Warren Assoc. (Ill.)
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Triana, Rafael (N.Y.)
Trigon Company, The (N.Y.)
Trumbower, Elizabeth Alban (N.Y.)
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Vavrik, Louis (Ohio)
Versen, Kurt Company (N.J.)
Vidal Research Corp. (N.J.)
Vin-Sea Corporation (Ill.)
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Von Nessen, Walter (N.Y.)
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Wright, Russel (N.Y.)
Wurster, David (Pa.)
Yoh, H. L. Company (Pa.)
York Research Corporation (N.Y.)

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Hopp Press, Inc. (N.Y.)
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Midwest Plastic Products Co. (Ill.)
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Palais Die Cut-Outs (Mass.)
Parisian Novelty Company (Ill.)
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Plastic Accessories, Inc. (N.Y.)
Plastic Engineering, Inc. (Ohio)
Plastics Service Co. (Calif.)
Precision Specialties (Calif.)
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Steiner Mfg. Co. (N.Y.)
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Werner, R. D. Co., Inc. (N.Y.)
Willson Magazine Camera Co. (Pa.)

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Aleks, Vytant (Ill.)
Alexander, Jerome (N.Y.)
Allen, Elliott A. (Calif.)
American Plastics Engineering Corp. (Michigan)
Aries, Robert S. (Conn.)
Arnkurt Associate Engineers (N.Y.)
Associate Engineering Co. (Mich.)
Aten-Davis Developments (N.Y.)
Axel Plastics (N.Y.)
Bacon & Weber (Ill.)
Barley, R. C. (Mass.)
Barnes & Reinecke (Ill.)
Barsky & Strauss, Inc. (N.Y.)
Bartelt Engineering Service (Ill.)
Bartolucci-Waldheim (Ill.)
Battalen, L. H. (N.Y.)
Bauman, Morton A. & Associates (Ohio)
Boulware Berry Associates (N.Y.)
Boyko, John (Mich.)
Brandenburger, Russell E. (Ind.)
Brosites Machine Co., Inc. (N.Y.)
Brown, E. Norris (Mass.)
Chemical Mfg. Sales Co. (Ill.)
Clark, Victor Marion Co. (N.Y.)
Classic Studio (N.Y.)
Conley, F. Company (Mich.)
Conley, Leonard B. (Texas)
Consolidated Management Consultants (New York)
Corner Simon Associates (N.Y.)
De Bell, George W. (Conn.)
DeBell & Richardson (Mass.)
Derham, Philip A. & Associates (Pa.)
Design Associates (N.Y.)
Design Service Company (N.J.)
Designers for Industry, Inc. (Ill.)
Designers for Industry, Inc. (Ohio)

[SERVICES, ENGINEER] Cont.
de Swart, Jan (Calif.)
Deutsch, Maurice (N.Y.)
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Engineering Associates (Ill.)
Esselen, Gustavus J., Inc. (Mass.)
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Franklin Industrial Engring. (Pa.)
Gordon, J. M. (N.Y.)
Graham, Crowley & Associates, Inc. (Ill.)
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Hart, William A. (Ill.)
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Hydraulic Machinery Inc. (Mich.)
Industrial Plastics Corp. (Wis.)
Johson-Cushing-Nevell (N.Y.)
Johnson, Gerald C. Associates (N.Y.)
K-Plastix (Calif.)
Karlstad, Andrew C. (Calif.)
Koblick, Freda (N.Y.)
Kopplin, Karl (Mo.)
Ledig, H. A. (Pa.)
Lincoln Engineering Company (Mo.)
Lithgow, James Company (Calif.)
McDonald, Sterling (Ill.)
Mangan & Eckland (Ill.)
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Martial & Scull (N.Y.)
Marx, Erich (Calif.)
Mast Development Company, Inc. (Iowa)
Maywald, Elmer C. (Ill.)
Mehrer, Ted (N.Y.)
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Nu-Engineering Company (Mich.)
Pellegrin, E. D. Co. (Ill.)
Plastic Design & Development Co. (Ohio)
Plastic Engineering Labs. (Calif.)
Plastic Mold Engineering Co. (Mich.)
Plastics Service Company (Calif.)
Plastics Service Engineering (Mich.)
Plastics Training Center (Calif.)
Poliner, William (N.Y.)
Precision Design Service (N.J.)
Product Engineering & Mfg. Corp. (Illinois)
Product Engineering & Tool Design Co. (New Jersey)
Productioneering Associates (Ill.)
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Resinous Research Associates (N.Y.)
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Snell, Foster D., Inc. (N.Y.)
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Stevenson, Holland Newton Jr. (Calif.)
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Vavrik, Louis (Ohio)
Versen, Kurt Company (N.J.)
Vidal Research Corp. (N.J.)
Vin-Sca Corporation (Ill.)
Walker Research Laboratory (N.Y.)
Warner Tool Design Corp. (N.Y.)
Wein, Samuel (N.Y.)
Weiss, John M. and Co. (N.Y.)
Wilkins, W. Burdette (N.J.)
Wilmet, Georges (N.Y.)
Winner, Lewis (N.Y.)
Yoh, H. L. Company (Pa.)
York Research Corporation (N.Y.)

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American Plywood Corp. (Wis.)
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Atlas Tool Works (Conn.)
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Comstock Engraving Company (N.Y.)
Condor Plastics Corp. (N. Y.)

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Brockton Tool Company (Mass.)
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Douglas Tool Co. (Mich.)
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Ebel & Kindermann (N.Y.)
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Engineering Specialties Corporation (Mich.)
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Ferriot Bros. Incorporated (Ohio)
Fortney Mfg. Co. (N.J.)
Franklin Industrial Engr. (Pa.)
Fray Machine Tool Co. (Cal.)
Gorton, George Machine Co. (Wis.)
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Hamilton Tool Company, The (Ohio)

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Hoggson & Pettis (Conn.)
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Impression Die Co. (Micb.)
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Kiemac Mfg. Co. (N.Y.)
Kunst, John Company, The (N.Y.)
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Leominster Tool Co., Inc. (Mass.)
Lester Engineering Co. (Ohio)
Liberty Tool & Machine Co. (N. J.)
Manning, Don & Co. (N.Y.)
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Modern Die & Mold Co. (Ill.)
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Modern Tool Works, Limited (Ontario, Canada)
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Muskoka Foundry Co., Ltd. (Ontario, Canada)
Naylor & Naylor (Ont., Can.)
Newark Die Company (N. J.)
Nu-Engineering Company (Mich.)
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Omego Tool & Die Works (Wash.)
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Paramount Die Mold Co. (Ill.)
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Pecrless Mold & Machine Div. (Ill.)
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Plastic Mold & Die Co. (Micb.)
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Plastics Service Company (Calif.)
Plastics Service Engineering (Mich.)
Precision Mold Company (Ill.)
Pro Manufacturing Co. (N. J.)
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Rudolph Novelty Co. (Ont., Can.)
Scandia Engineering Co. (Calif.)
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Sintered Metals, Inc. (Mass.)
Sossner Steel Stamps (N. Y.)
Special Tool & Machine Co. (Mass.)
Spitfire Tools, Inc. (Ill.)
Standard Tool Co. (Mass.)
Stanek Tool & Mfg. Co. (Wis.)
Steinen, Wm. Mfg. Co. (N. J.)
Sterling Industries (Ill.)
Stricker-Brunhuber Co. (N. Y.)
Summit Roberts Tool Co. (Ohio)
Superior Plastic Mold Co. (Ill.)
Tech-Art Plastics Co. (N. Y.)
Thermoid Mould and Tool Works, Ltd. (Ontario, Canada)
Thwing-Albert Instrument Company
Tilp, J. G., Inc. (N. J.)
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Wentworth Machine Co., Ltd. (Ontario, Canada)
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For the Army's Republic Thunderbolt, Pyro molded this plostic ventilotar tube and nozzle. The ventilotor tube is 17" long, both halves malded in one shot.

Color Makes a Lot of Difference

You can mold a plastic part or product in the exact color you want. The color becomes an integral part of the molding and retains its finish during a lifetime of service. Color is only one of the many reasons for using plastics. Lightness . . . Strength . . . Durability . . . are others. If you are considering the use of plastics in your new designs, put your problems up to Pyro. Write to Pyro Plastics Corporation, Westfield, New Jersey.

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Kawin, Charles C. Co. (Ill.)
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Miles, J. L. Laboratory (N.Y.)
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Howard Inspecting and Testing Laboratory (N.J.)
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X-Ray

St. John X-Ray Service, Inc. (N.Y.)

TOOLING MATERIALS

(see Casting Resins, page 86)

COMPARATIVE GUIDE TO PLASTICS' PROPERTIES

THE bar charts in the following pages are intended as a comparative guide to the physical, electrical, and thermal properties of the conventional plastics materials. Data for these charts were obtained largely from the handbook of the Plastics Materials Manufacturers' Association, *Technical Data on Plastics* (April, 1945), which points out that:

> "where a range in value for a property is given, it may signify either (a) the range within which the values for all members of the group described will fall or (b) approximately the variation which should be expected and allowed for from lot to lot or batch to batch for any member of the group. In many cases, it has been possible to 'type' materials so closely that ranges in value shown are much more nearly the latter. If materials of more exactly defined properties are desired, further inquiry should be made as to the possibilities of obtaining them. Where only a single value is given, it may be taken, as a rule, to indicate that either data available were limited or minimum values only are shown."

Furthermore, where particular properties are not charted for any plastics, the reason may be either that the particular property or test is not applicable or that the information is not of general interest.

For some properties the same test is not applicable to all plastics. For example, there are two scales for Rockwell hardness—one for the softer and one for the harder materials, and the two are not comparable.

Where the values for a given property are not always derived from the same ASTM test, it is believed that they are reasonably comparable. For casein, most of the values were obtained from the manufacturers' own tests, which were not specified. For an explanation why the values given for a particular property may not be always realized in a molded product, see the introductory statement to the tables of properties of Molded Plastics.

Supplementing the figures taken from *Technical Data on Plastics* for the charts, data on melamine laminates were obtained from Continental-Diamond Fibre Co. and American Cyanamid Co.; data on molding blanks, from the Columbian Rope Company and the Bakelite Corporation; and data on resin fibres, from the Keyes Fibre Company and the Hawley Products Company.

The charts were prepared by Graphic Associates, New York.

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Strasburger & Siegel (Md.)
Textor Lahoratories, The (Ohio)
Thompson & Lichtner Co., Inc., The (Mass.)
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Van Trump Testing Laboratory (Illinois)
Wahl-Henius Institute (Ill.)
Warner Laboratories (Pa.)
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Wiedemann, H. E. (Mo.)
Wiley and Company, Inc. (Md.)
Williams, A. W. Inspection Co. (Ala.)
Williams, Bruce Laboratories, The (Mo.)
Winkler, Adolph J. (N.Y.)

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Williams, Bruce Laboratories, The (Mo.)

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Laucks Laboratories, Inc., The (Washington)
Pellegrin, A. L. & Son (Calif.)

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Bowser-Morner Testing Lahoratories (Ohio)
Buckmaster-Patton Laboratory, The (Pa.)
Buffalo Testing Lahoratories, Inc. (N.Y.)
Chicago Testing Lahoratory (Ill.)
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Coleman, W. B. & Co. (Pa.)
Columhus Laboratories, The (Ill.)
Dallas Laboratories, The (Tex.)
Ekroth Lahoratories, Inc. (N.Y.)
Electrical Testing Lahoratories (N.Y.)
Fassett, C. M. Co., Inc., The (Wash.)
Flood, Walter H. & Co. (Ill.)
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Hale, George A. (Mo.)
Harris Laboratories (Nehr.)
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Oklahoma Testing Laboratories (Okla.)
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Osborne, Raymond G. Lahoratories (Calif.)
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Patzig Testing Laboratories (Iowa)
Pease Laboratories, Inc. (N.Y.)
Pitkin, Lucius, Inc. (N.Y.)
Robinson, Louis G. Laboratories, The (Ohio)
Samson Laboratories (Pa.)
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Shilstone Testing Laboratory (Louisiana)
Snell, Foster D., Inc. (N.Y.)
Southwestern Laboratories (Tex.)
Stewart Research Laboratory (Virginia)
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Stillwell & Gladding, Inc. (N.Y.)
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Twining Lahoratories, The (Calif.)
United States Testing Co., Inc. (N.J.)
Van Trump Testing Laboratory, The (Ill.)
Wahl-Henius Institute (Ill.)
Wayne Laboratories, The (Pa.)
Wiedemann, H. E. (Mo.)
Williams, Bruce Laboratories, The (Mo.)

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Buckmaster-Patton Laboratory (Pennsylvania)
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Burt, R. C. Scientific Laboratories (Calif.)
California Testing Laboratories, Inc. (Calif.)
Chicago Testing Laboratory (Ill.)
Coleman, W. B. & Co. (Pa.)
Conwell, E. L. & Co. (Pa.)
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Deavitt Lahoratories (Ill.)
Detroit Testing Lahoratory, The (Mich.)
Ekroth Lahoratories, Inc. (N.Y.)
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Electrical Testing Lahoratories (N.Y.)
Fassett, C. M. Co., Inc., The (Wash.)
Flood, Walter H. & Co. (Ill.)
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Parker Lahoratory (S.C.)
Patzig Testing Laboratories, The (Iowa)
Pierce Testing Laboratories, The (Colo.)
Pitkin, Lucius, Inc. (N.Y.)
Pittsburgh Testing Lahoratory (Pa.)
Poste, Emerson P. (Tenn.)
Purdy, W. S. Co., Inc. (N.Y.)
Samson Laboratories (Pa.)
Saxl Instrument Co., Inc. (R.I.)
Saybolt, E. W. & Co. (Tex.)
Shilstone Testing Lahoratory (La.)
Skinner & Sherman, Inc. (Mass.)
Smith-Emery Co. (Calif.)
Snell, Foster D., Inc. (N.Y.)
Stewart Research Laboratory (Virginia)
Stillman & Van Siclen, Inc. (N.Y.)
Toledo Testing Laboratory (Ohio)
Twin City Testing and Engineering Laboratory, Inc. (Minn.)
Twining Lahoratories, The (Calif.)
United States Testing Co., Inc. (N.J.)
Van Cleve Laboratories, Inc. (Minnesota)
Van Trump Testing Lahoratory (Ill.)
Wahl-Henius Institute (Ill.)
Wayne Laboratories, The (Pa.)
Williams, A. W. Inspection Co. (Ala.)
Williams, Bruce Lahoratories, The (Mo.)

Service, Performance Calibration

Associated Electric Lahoratories, Inc. (Ill.)
Better Fabrics Testing Bureau, Inc. (N.Y.)
Betz, W. H. & L. D. (Pa.)
Bowser-Morner Testing Lahoratories (Ohio)
Bull and Roberts (N.Y.)
California Testing Lahoratories, Inc. (Calif.)
Coleman, W. B. & Co. (Pa.)
Detroit Testing Lahoratory, The (Mich.)
Ekroth Lahoratories, Inc. (N.Y.)
Electrical Testing Laboratories (N.Y.)
Factory Mutual Laboratories (Massachusetts)
Hildreth & Co., Inc. (N.Y.)
Hunt, Robert W. Co. (Ill.)
Indiana Lahoratories Co., The (Ind.)
LaWall and Harrisson (Pa.)
Maywald, Frederick, J. (N.J.)
Molnar Lahoratories (N.Y.)
National Association of Dyers and Cleaners (Md.)
New York Testing Lahoratories, Inc. (N.Y.)
Oklahoma Testing Lahoratories (Okla.)
Oshorne, Raymond G. Lahoratories (Calif.)
Patzig Testing Lahoratories (Iowa)
Pease Laboratories, Inc. (N.Y.)
Pittsburgh Testing Laboratory (Pennsylvania)
Purdy, W. S. Co., Inc. (N.Y.)
Samson Lahoratories (Pa.)
Snell, Foster D., Inc. (N.Y.)
Stewart Research Laboratory (Va.)
Twin City Testing and Engineering Laboratory, Inc. (Minn.)
United States Testing Co., Inc. (N.J.)
Van Trump Testing Lahoratory (Ill.)
Wahl-Henius Institute (Ill.)
Wayne Lahoratories, The (Pa.)
Weiss & Downs, Inc. (N.Y.)

X-Ray

St. John X-Ray Service, Inc. (N.Y.)

TOOLING MATERIALS

(see Casting Resins, page 86)

COMPARATIVE GUIDE TO PLASTICS' PROPERTIES

THE bar charts in the following pages are intended as a comparative guide to the physical, electrical, and thermal properties of the conventional plastics materials. Data for these charts were obtained largely from the handbook of the Plastics Materials Manufacturers' Association, *Technical Data on Plastics* (April, 1945), which points out that:

> "where a range in value for a property is given, it may signify either (a) the range within which the values for all members of the group described will fall or (b) approximately the variation which should be expected and allowed for from lot to lot or batch to batch for any member of the group. In many cases, it has been possible to 'type' materials so closely that ranges in value shown are much more nearly the latter. If materials of more exactly defined properties are desired, further inquiry should be made as to the possibilities of obtaining them. Where only a single value is given, it may be taken, as a rule, to indicate that either data available were limited or minimum values only are shown."

Furthermore, where particular properties are not charted for any plastics, the reason may be either that the particular property or test is not applicable or that the information is not of general interest.

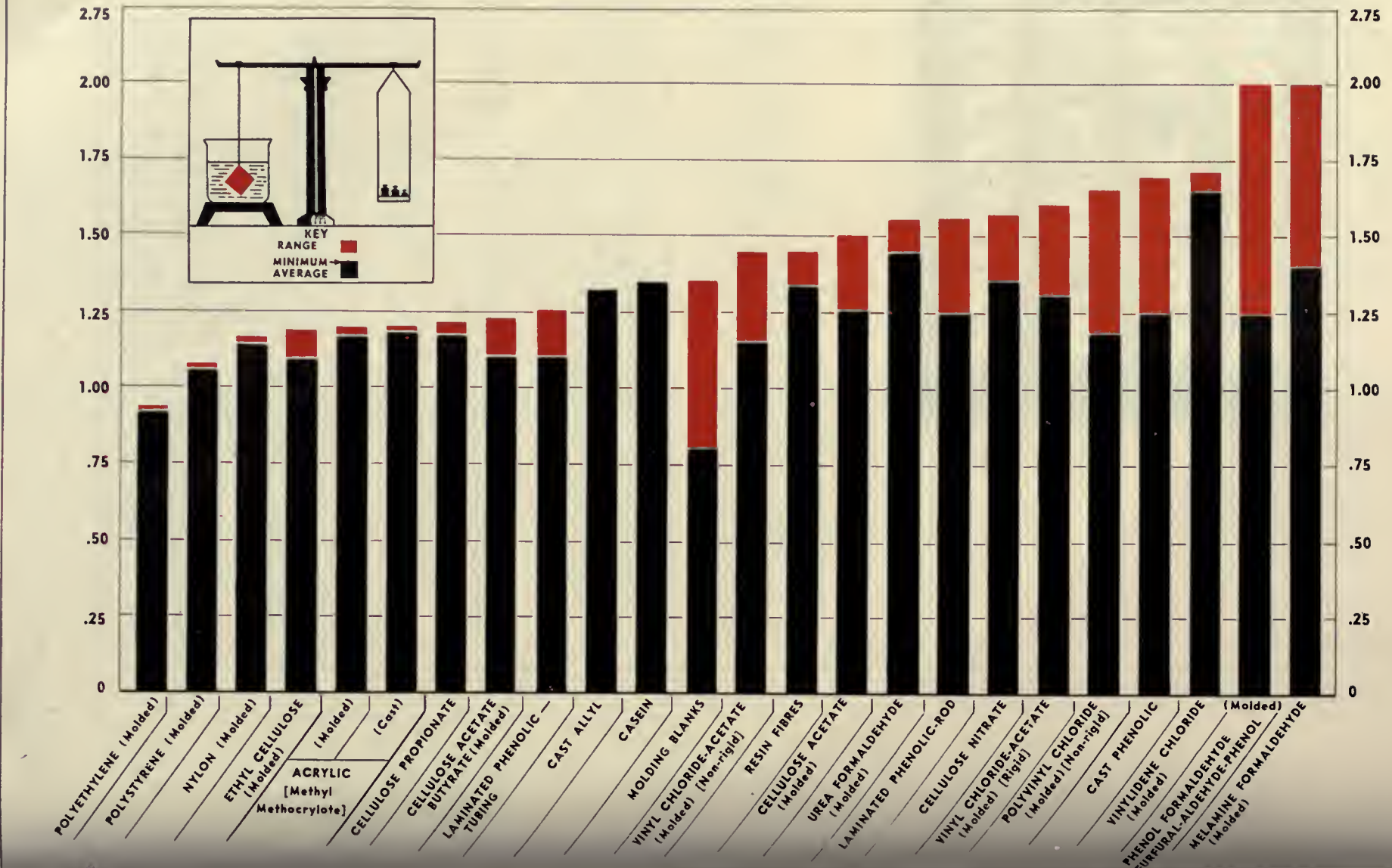
For some properties the same test is not applicable to all plastics. For example, there are two scales for Rockwell hardness—one for the softer and one for the harder materials, and the two are not comparable.

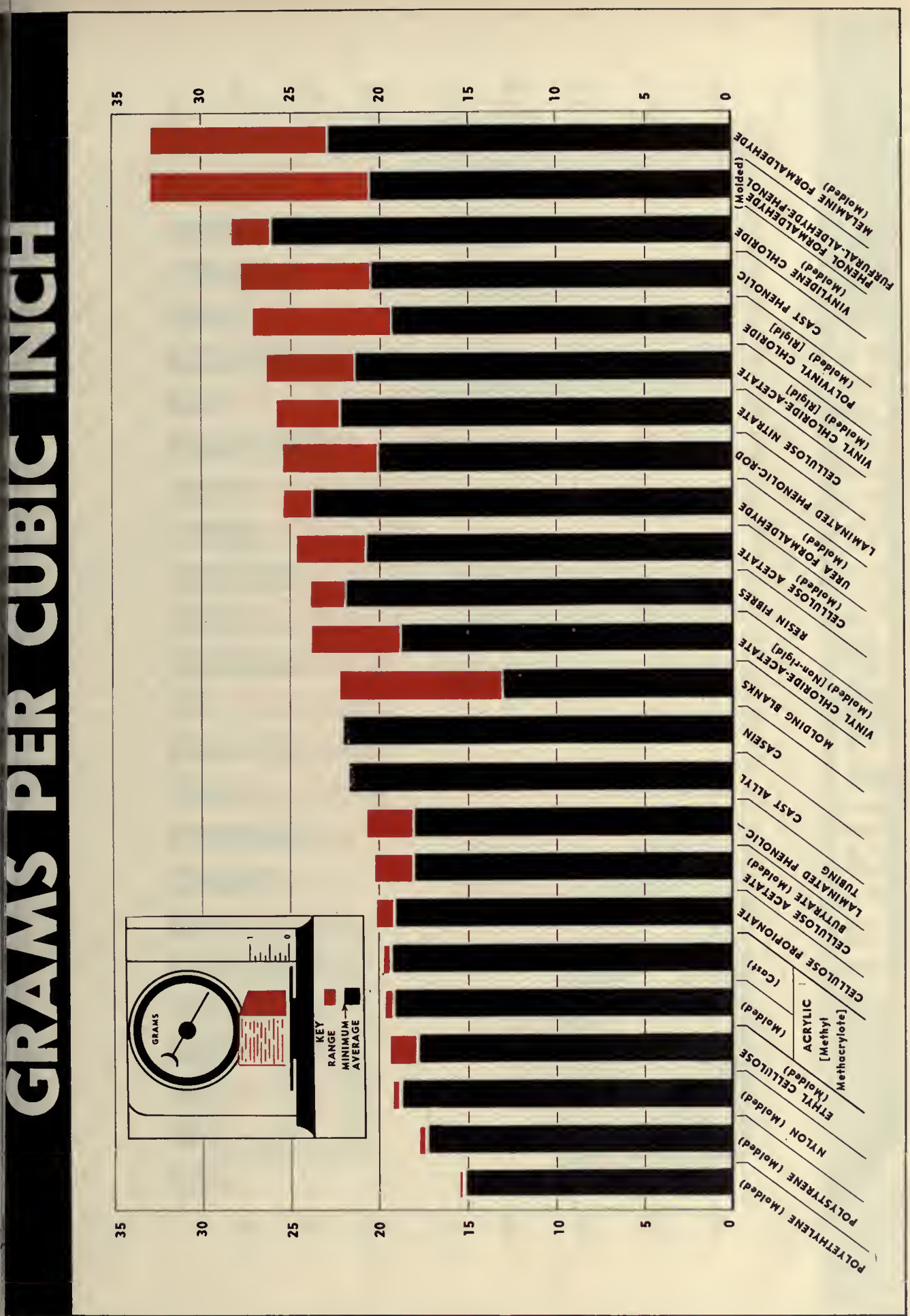
Where the values for a given property are not always derived from the same ASTM test, it is believed that they are reasonably comparable. For casein, most of the values were obtained from the manufacturers' own tests, which were not specified. For an explanation why the values given for a particular property may not be always realized in a molded product, see the introductory statement to the tables of properties of Molded Plastics.

Supplementing the figures taken from *Technical Data on Plastics* for the charts, data on melamine laminates were obtained from Continental-Diamond Fibre Co. and American Cyanamid Co.; data on molding blanks, from the Columbian Rope Company and the Bakelite Corporation; and data on resin fibres, from the Keyes Fibre Company and the Hawley Products Company.

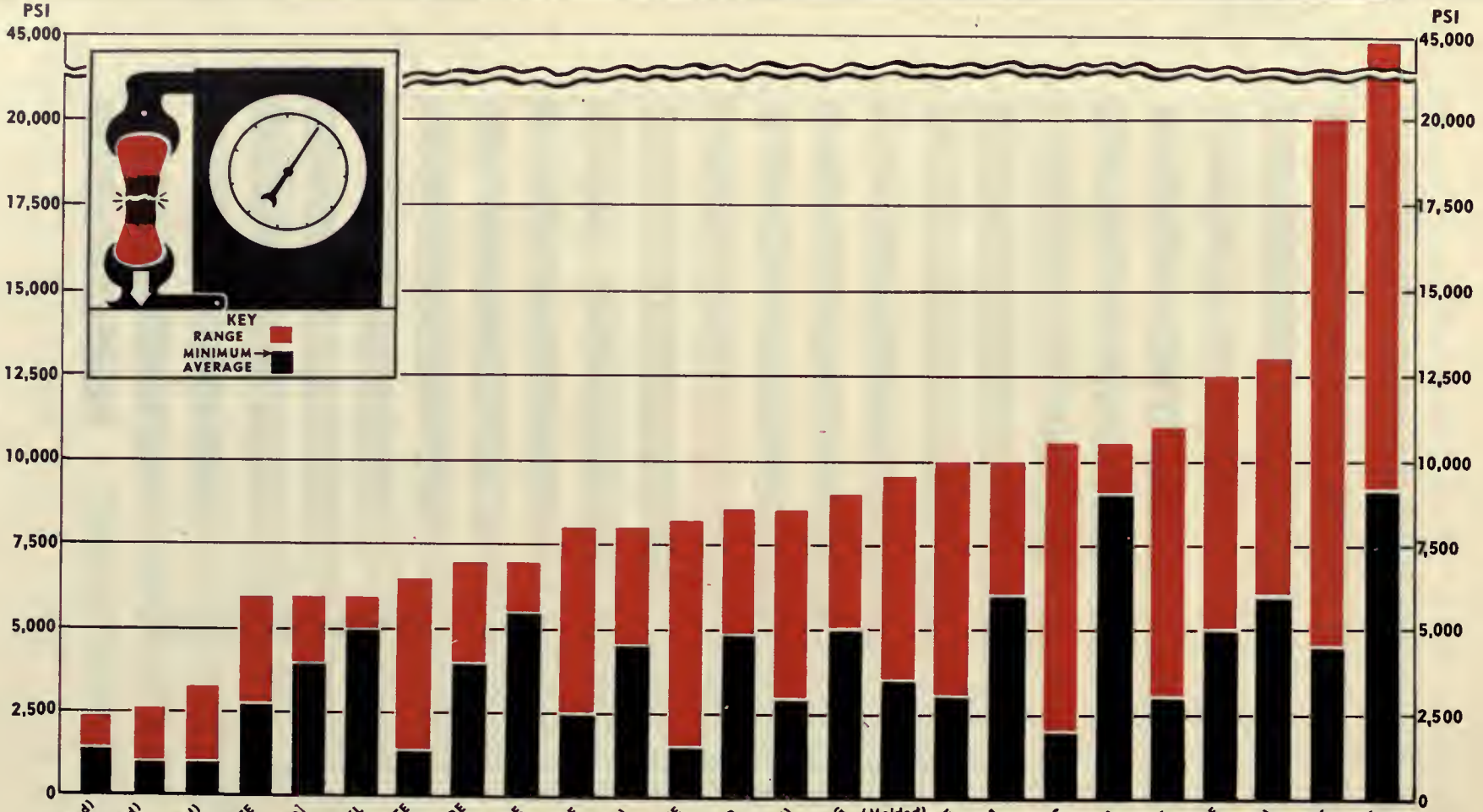
The charts were prepared by Graphic Associates, New York.

SPECIFIC GRAVITY

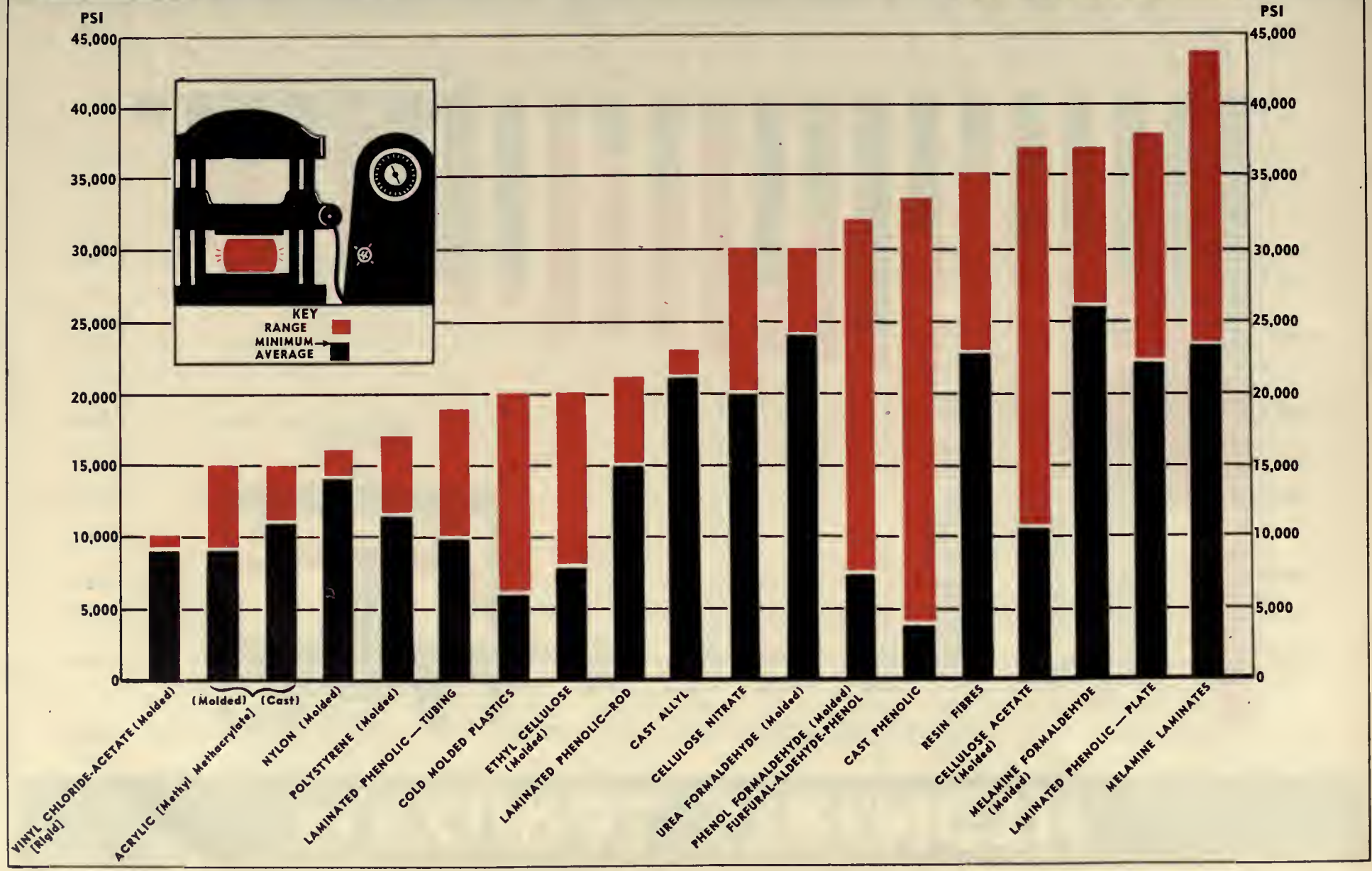



GRAMS PER CUBIC INCH
0
5
10
15
20
25
30
35
KEY
RANGE
MINIMUM
AVERAGE
GRAMS
POLYETHYLENE (Molded)
POLYSTYRENE (Molded)
NYLON (Molded)
ETHYL CELLULOSE (Molded)
ACRYLIC [Methyl Methacrylate]
(Molded)
(Cast)
CELLULOSE PROPIONATE
CELLULOSE ACETATE BUTYRATE (Molded)
LAMINATED PHENOLIC-TUBING
CAST ALLYL
CASEIN
MOLDING BLANKS
VINYL CHLORIDE-ACETATE (Molded) [Non-rigid]
RESIN FIBRES
CELLULOSE ACETATE (Molded)
UREA FORMALDEHYDE (Molded)
LAMINATED PHENOLIC-ROD (Molded)
CELLULOSE NITRATE
VINYL CHLORIDE-ACETATE (Molded) [Rigid]
POLYVINYL CHLORIDE (Molded) [Rigid]
CAST PHENOLIC (Molded)
VINYLIDENE CHLORIDE (Molded)
PHENOL FORMALDEHYDE (Molded)
FURFURAL-ALDEHYDE-PHENOL (Molded)
MELAMINE FORMALDEHYDE (Molded)

TENSILE STRENGTH



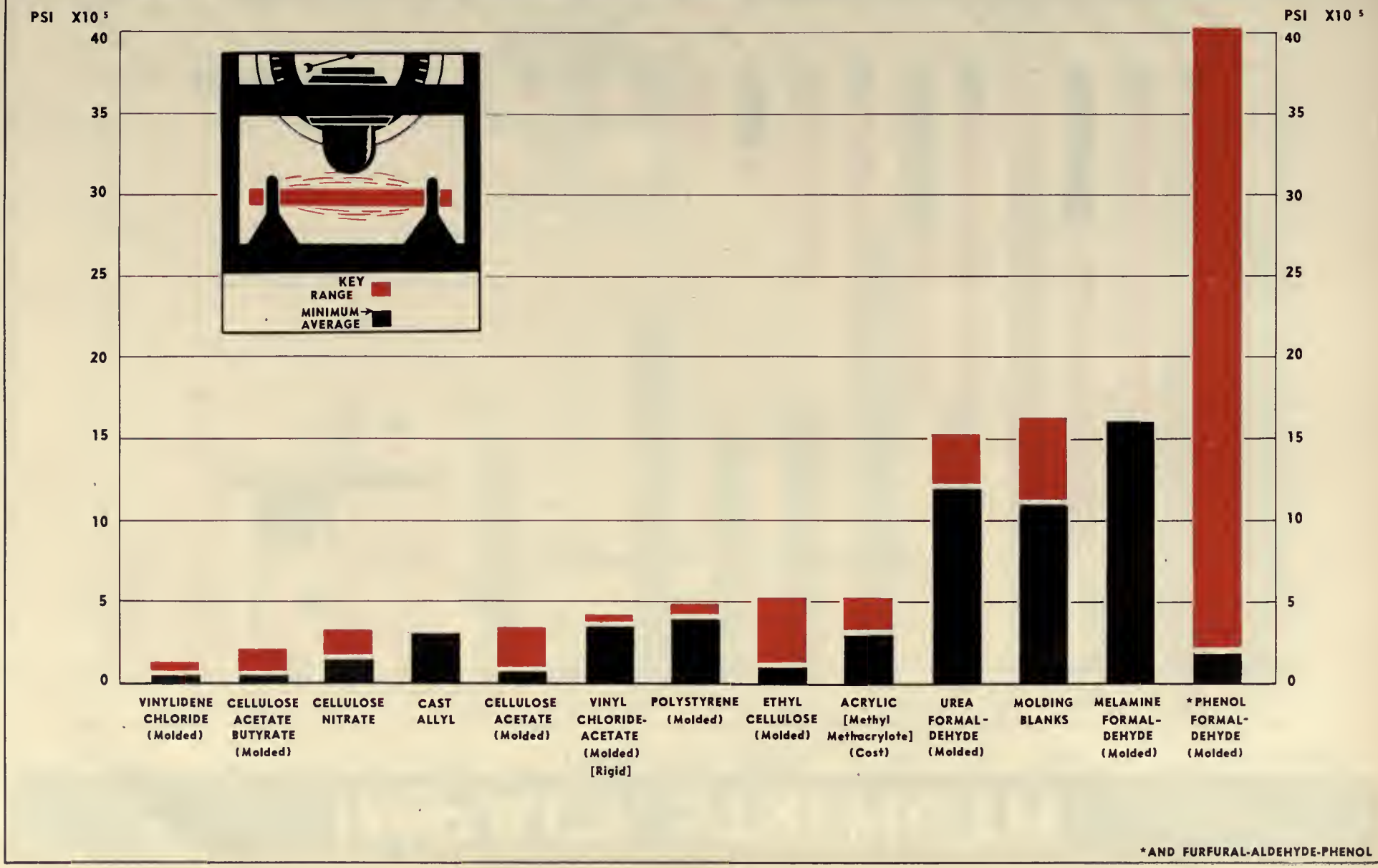
COMPRESSIVE STRENGTH



FLEXURAL STRENGTH

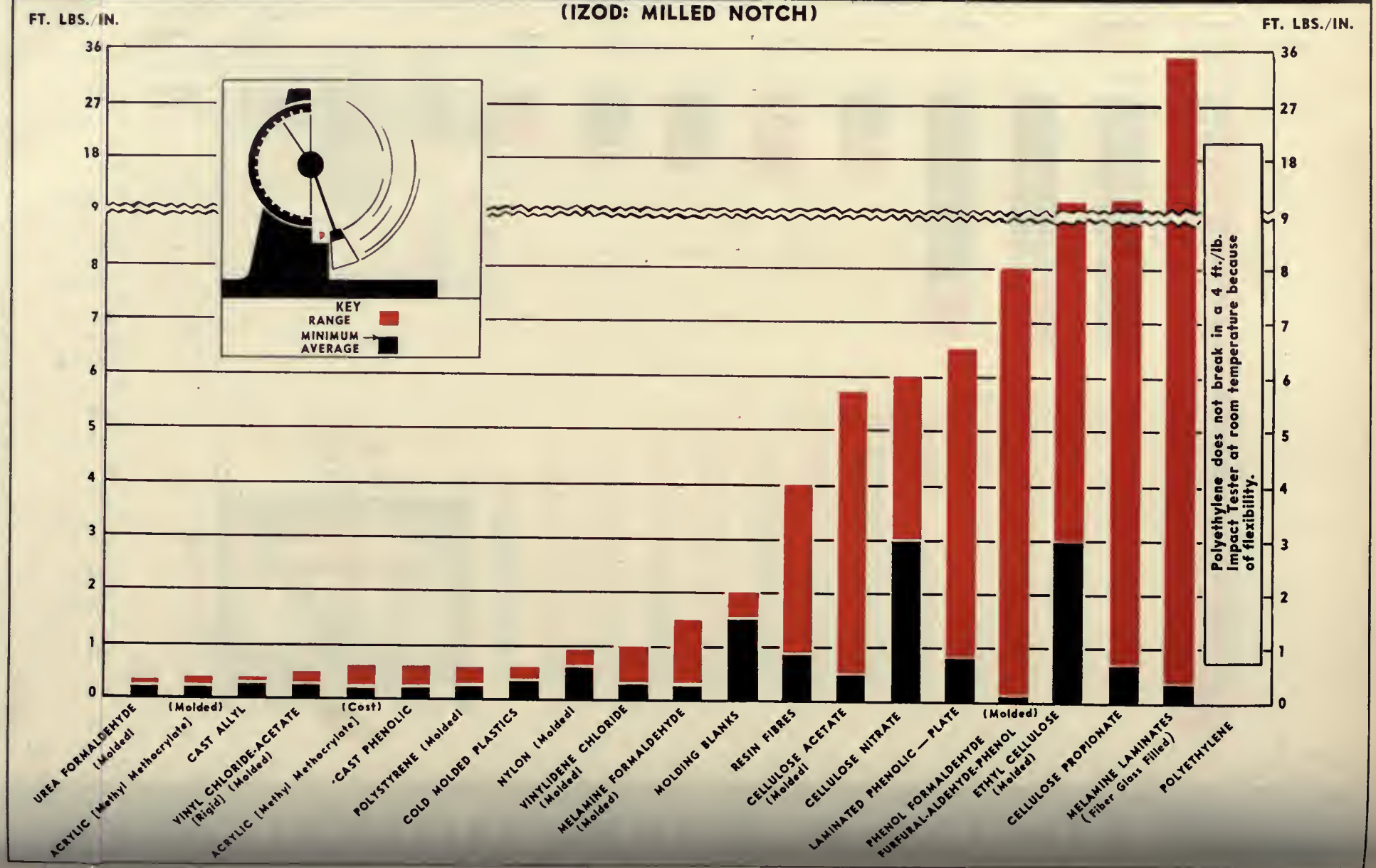
MODULUS OF ELASTICITY

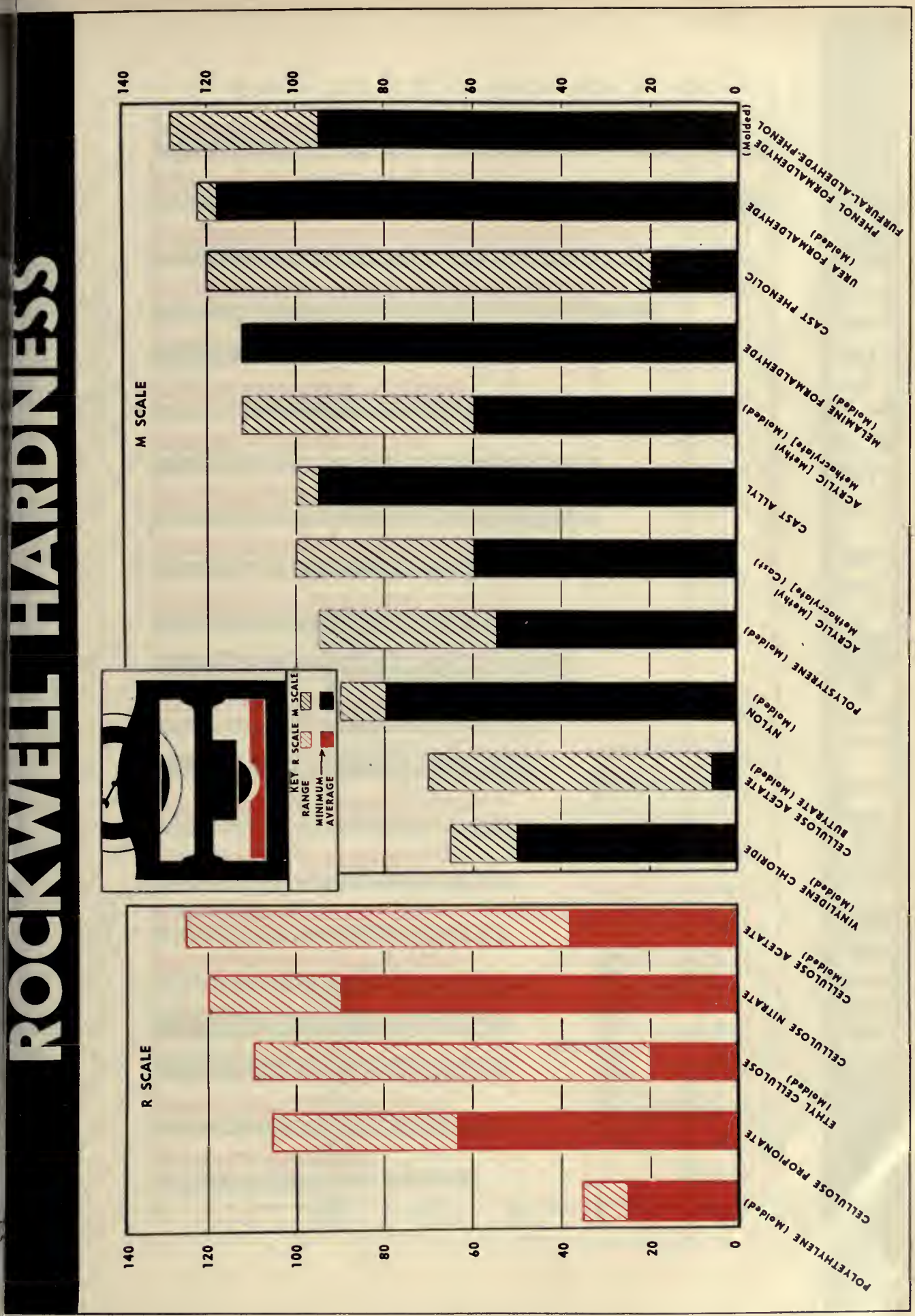
(IN FLEXURE)



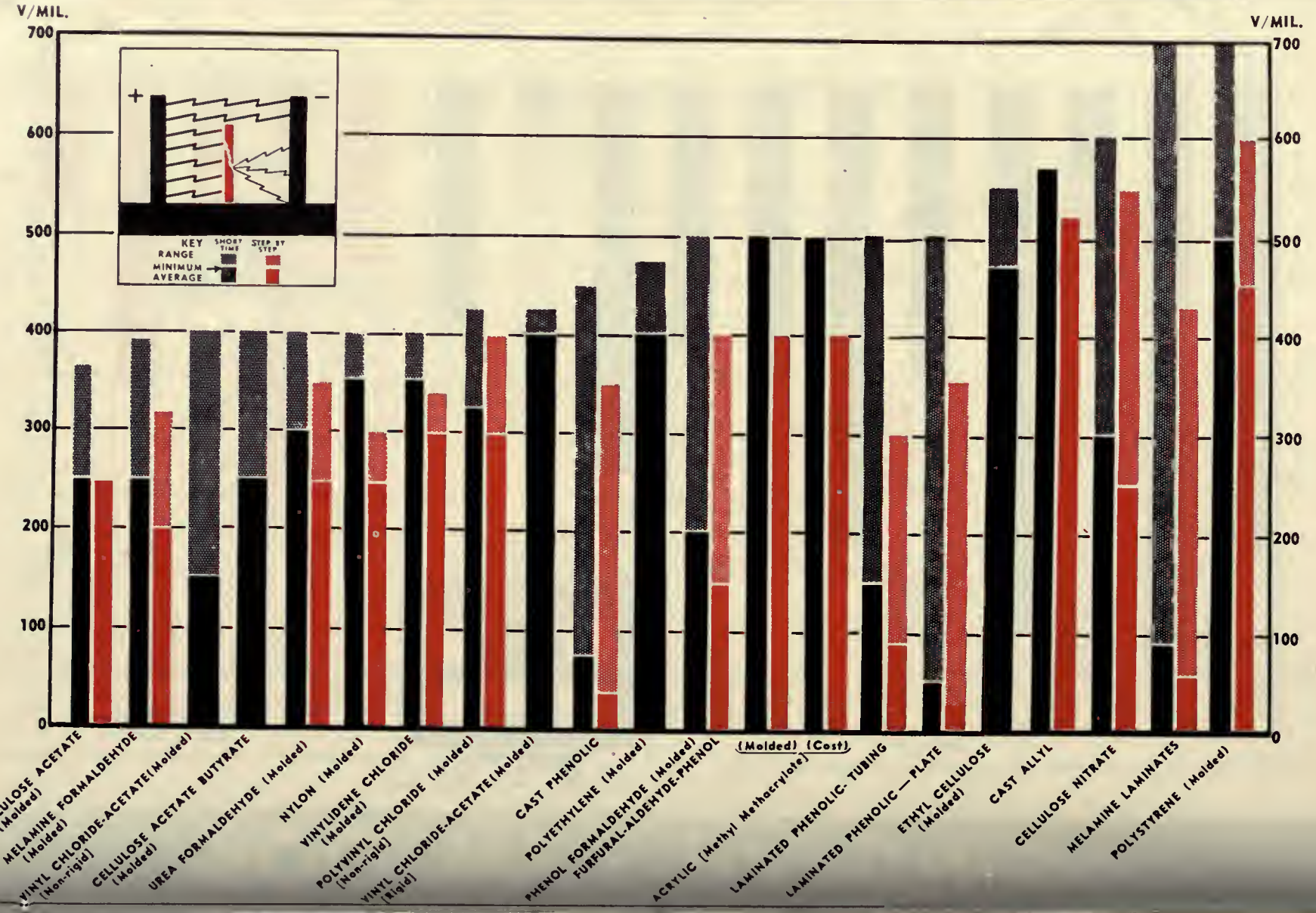
*AND FURFURAL-ALDEHYDE-PHENOL

IMPACT STRENGTH

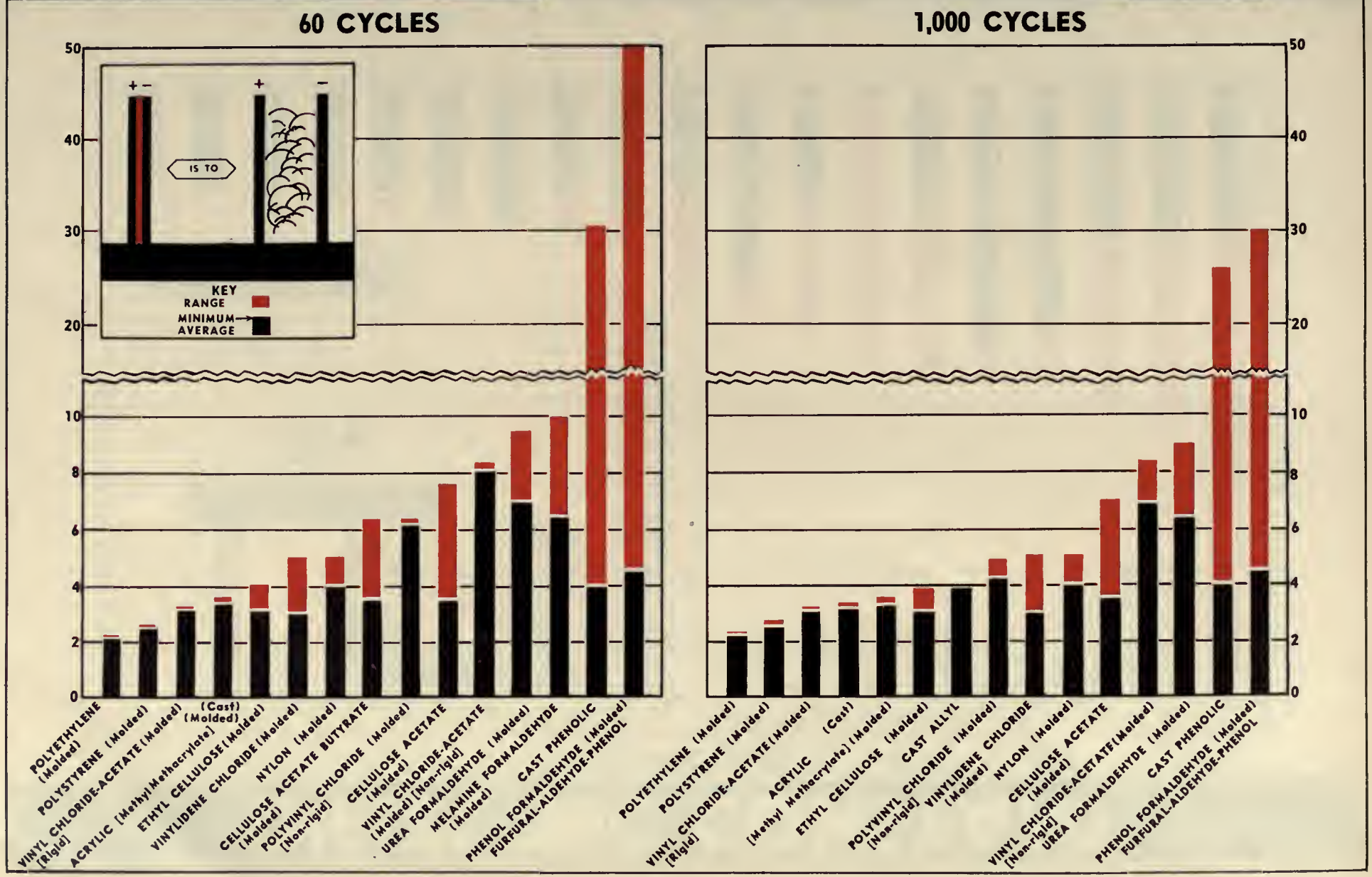



ROCKWELL HARDNESS
M SCALE
R SCALE
140
120
100
80
60
40
20
0
KEY R SCALE M SCALE
RANGE
MINIMUM
AVERAGE
PHENOL FORMALDEHYDE-FURFURAL-ALDEHYDE-PHENOL (Molded)
UREA FORMALDEHYDE (Molded)
CAST PHENOLIC
MELAMINE FORMALDEHYDE (Molded)
ACRYLIC [Methyl Methacrylate] (Molded)
CAST ALLYL
ACRYLIC [Methyl Methacrylate] (Cast)
POLYSTYRENE (Molded)
NYLON (Molded)
CELLULOSE ACETATE BUTYRATE (Molded)
VINYLIDENE CHLORIDE (Molded)
CELLULOSE ACETATE (Molded)
CELLULOSE NITRATE
ETHYL CELLULOSE (Molded)
CELLULOSE PROPIONATE
POLYETHYLENE (Molded)

DIELECTRIC STRENGTH

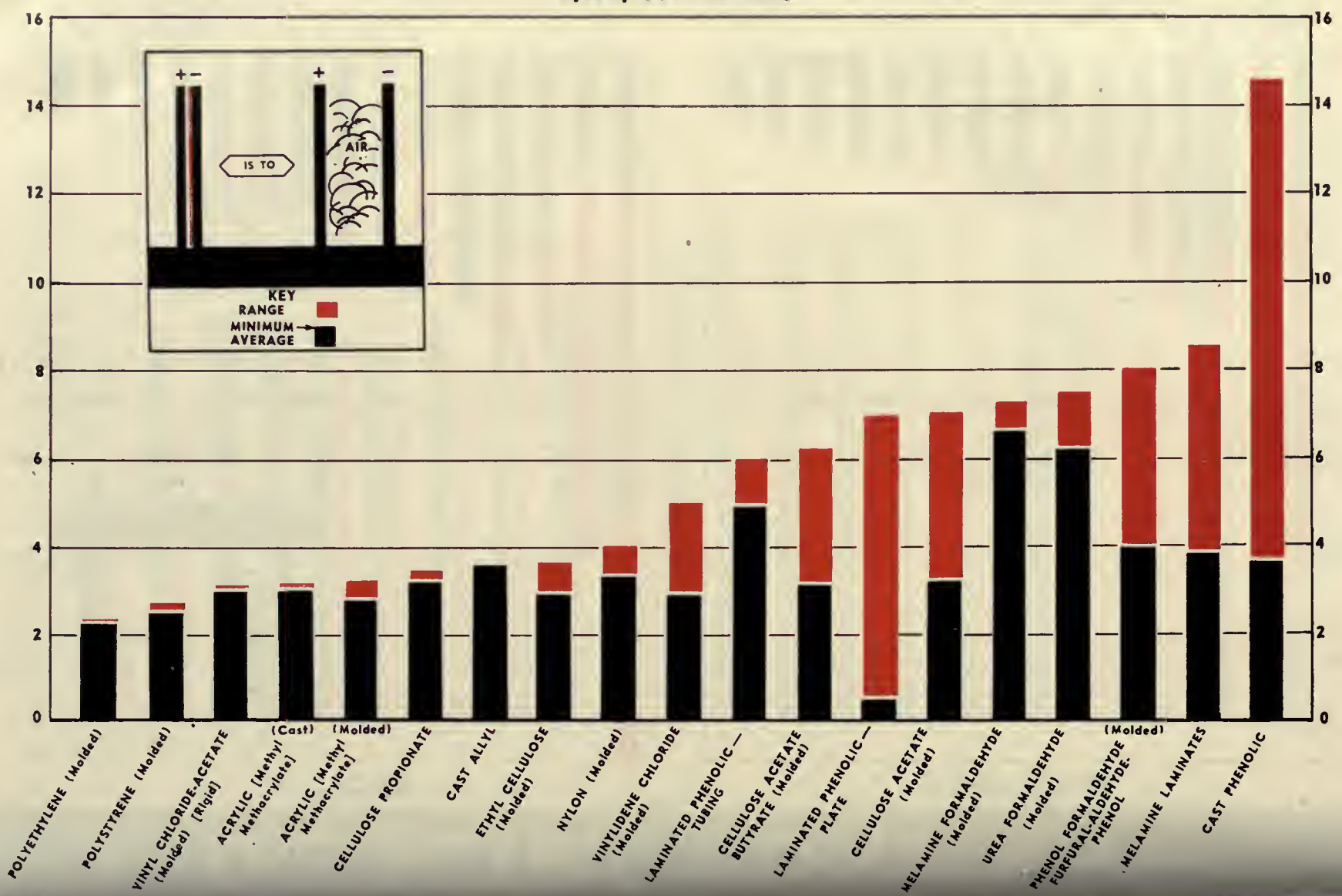


DIELECTRIC CONSTANT

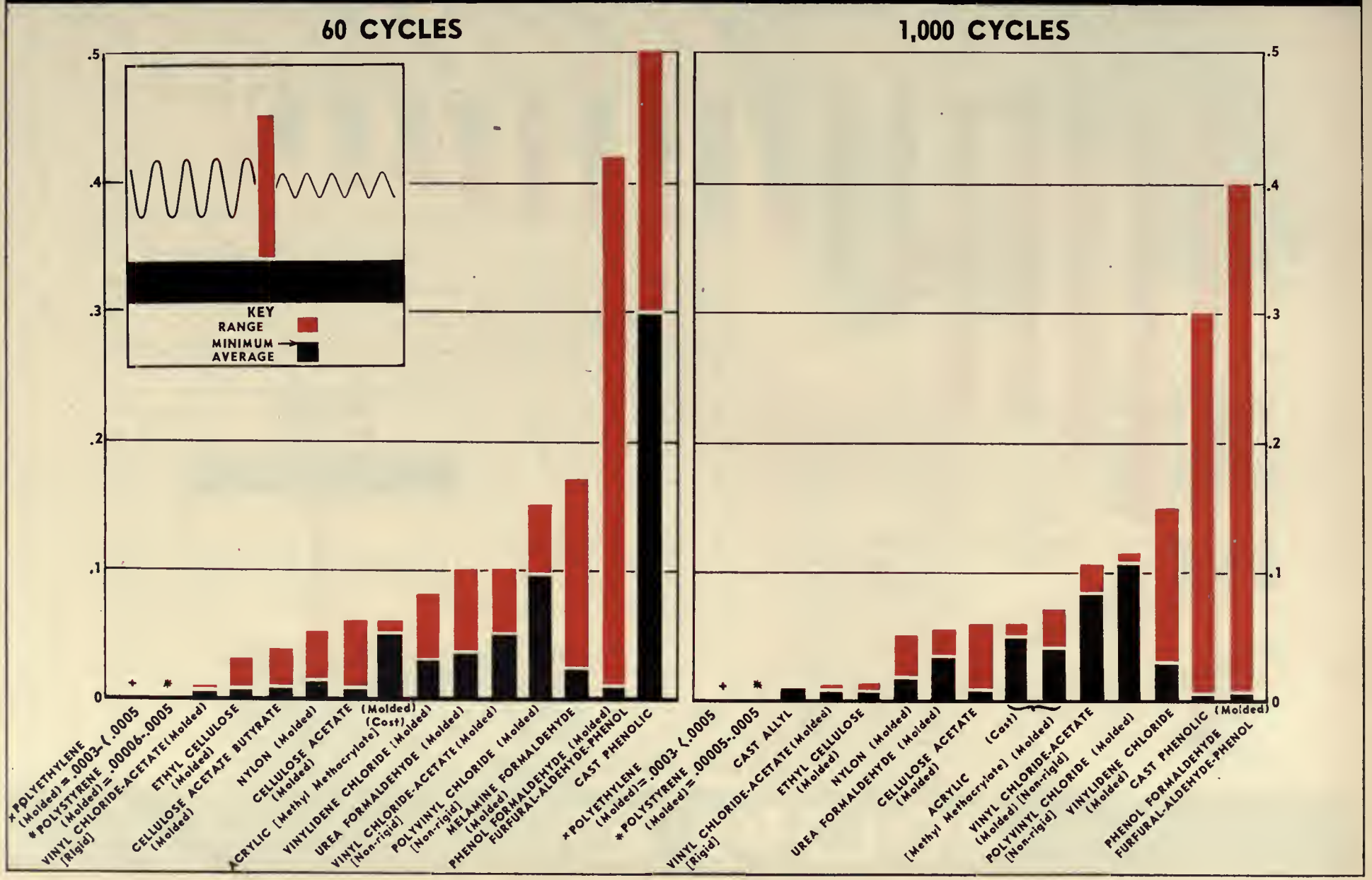


DIELECTRIC CONSTANT

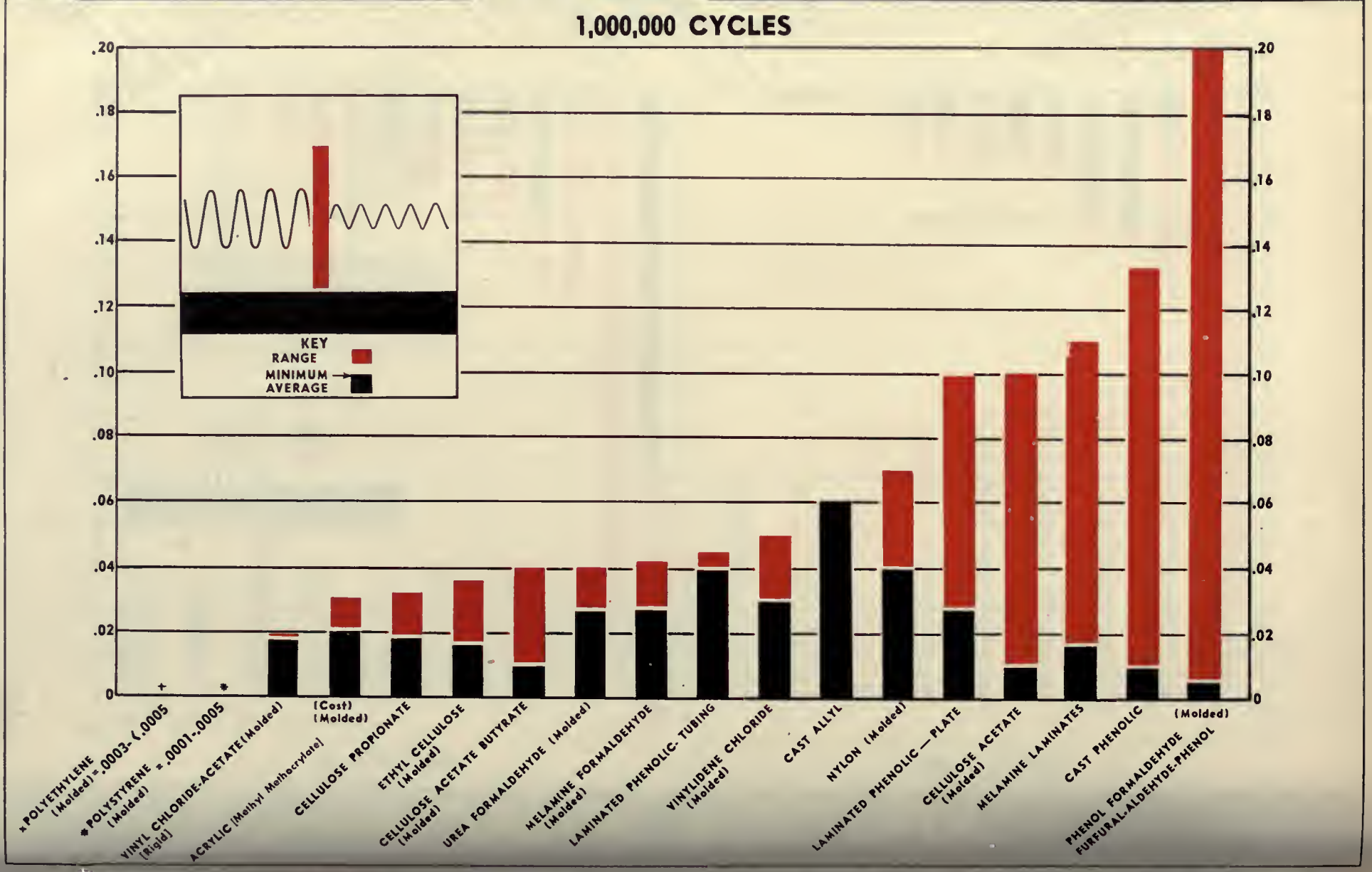
1,000,000 CYCLES



POWER FACTOR



POWER FACTOR



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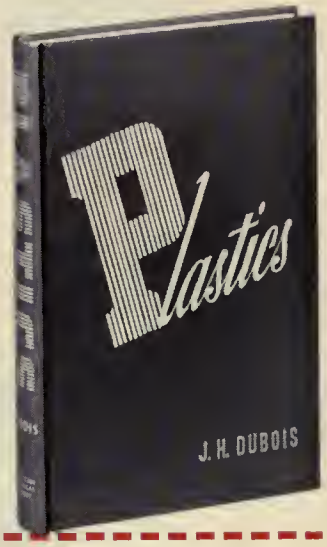

CONTENTS

stics molding
oduct design
pes of Molds
ol-making equipment and methods
old making materials
signing and drafting practice
mpression molds
ansfer molds
jection molds
old-mold and extrusion die design
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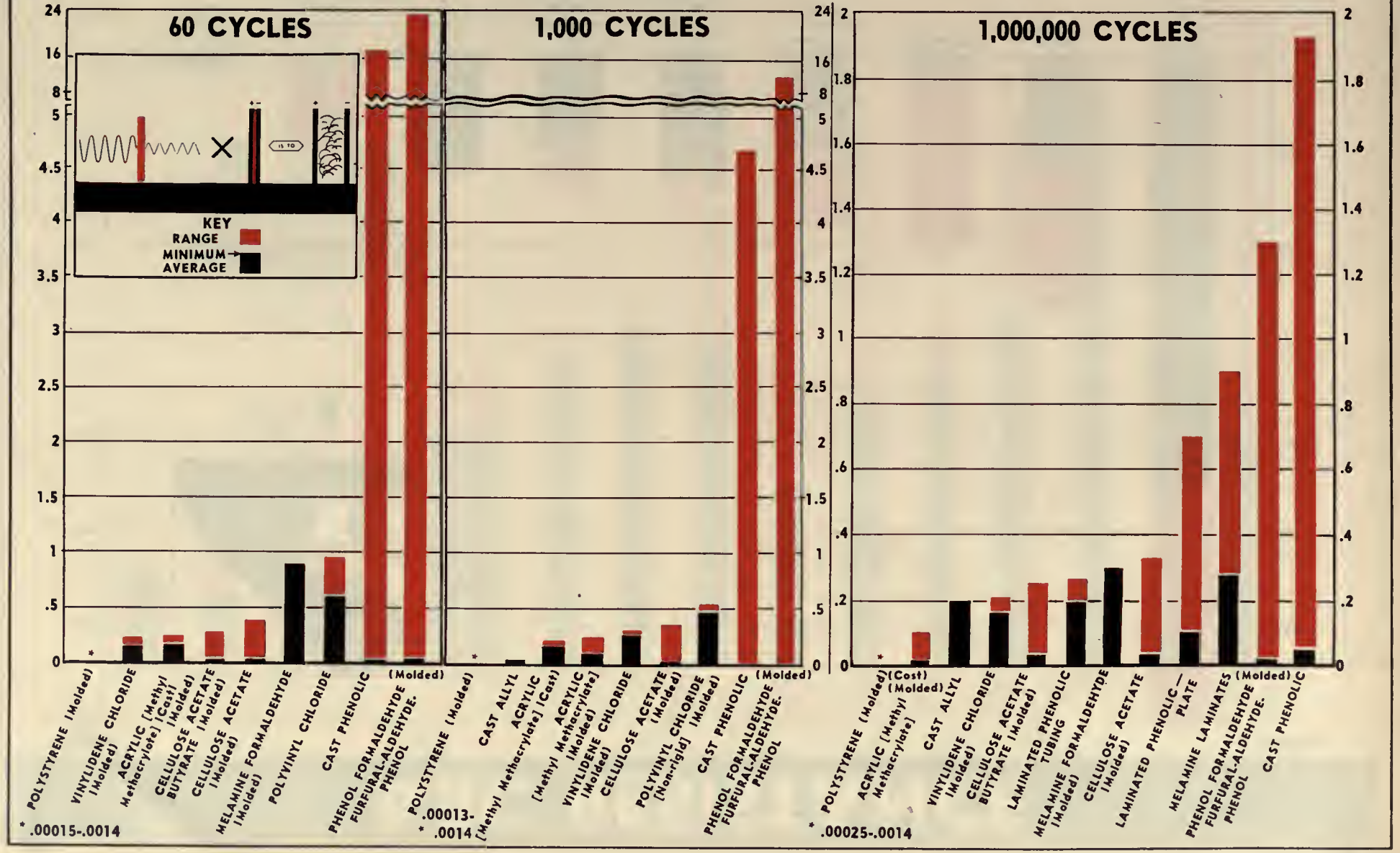
60 CYCLES
1,000 CYCLES
1,000,000 CYCLES
KEY
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24
16
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0
POLYSTYRENE (Molded)
VINYLIDENE CHLORIDE (Molded)
ACRYLIC (Methyl Methacrylate) (Cast) (Molded)
CELLULOSE ACETATE BUTYRATE (Molded)
CELLULOSE ACETATE (Molded)
MELAMINE FORMALDEHYDE (Molded)
POLYVINYL CHLORIDE
CAST PHENOLIC
PHENOL FORMALDEHYDE FURFURAL-ALDEHYDE-PHENOL (Molded)
* .00015-.0014
POLYSTYRENE (Molded)
CAST ALLYL
ACRYLIC (Methyl Methacrylate) (Cast)
ACRYLIC (Methyl Methacrylate) (Molded)
VINYLIDENE CHLORIDE (Molded)
CELLULOSE ACETATE (Molded)
POLYVINYL CHLORIDE (Non-rigid) (Molded)
CAST PHENOLIC
PHENOL FORMALDEHYDE FURFURAL-ALDEHYDE-PHENOL (Molded)
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CAST ALLYL
VINYLIDENE CHLORIDE (Molded)
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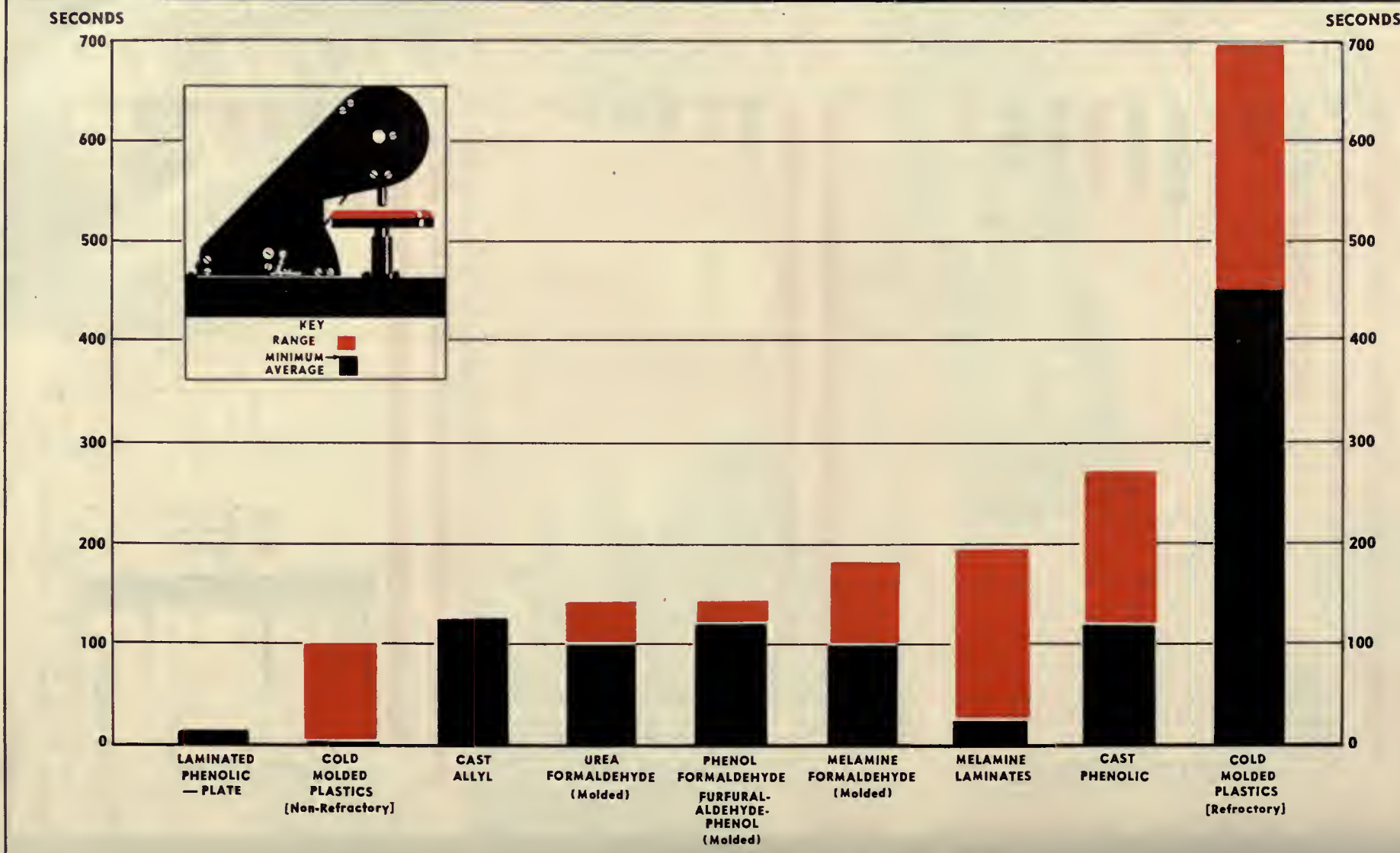
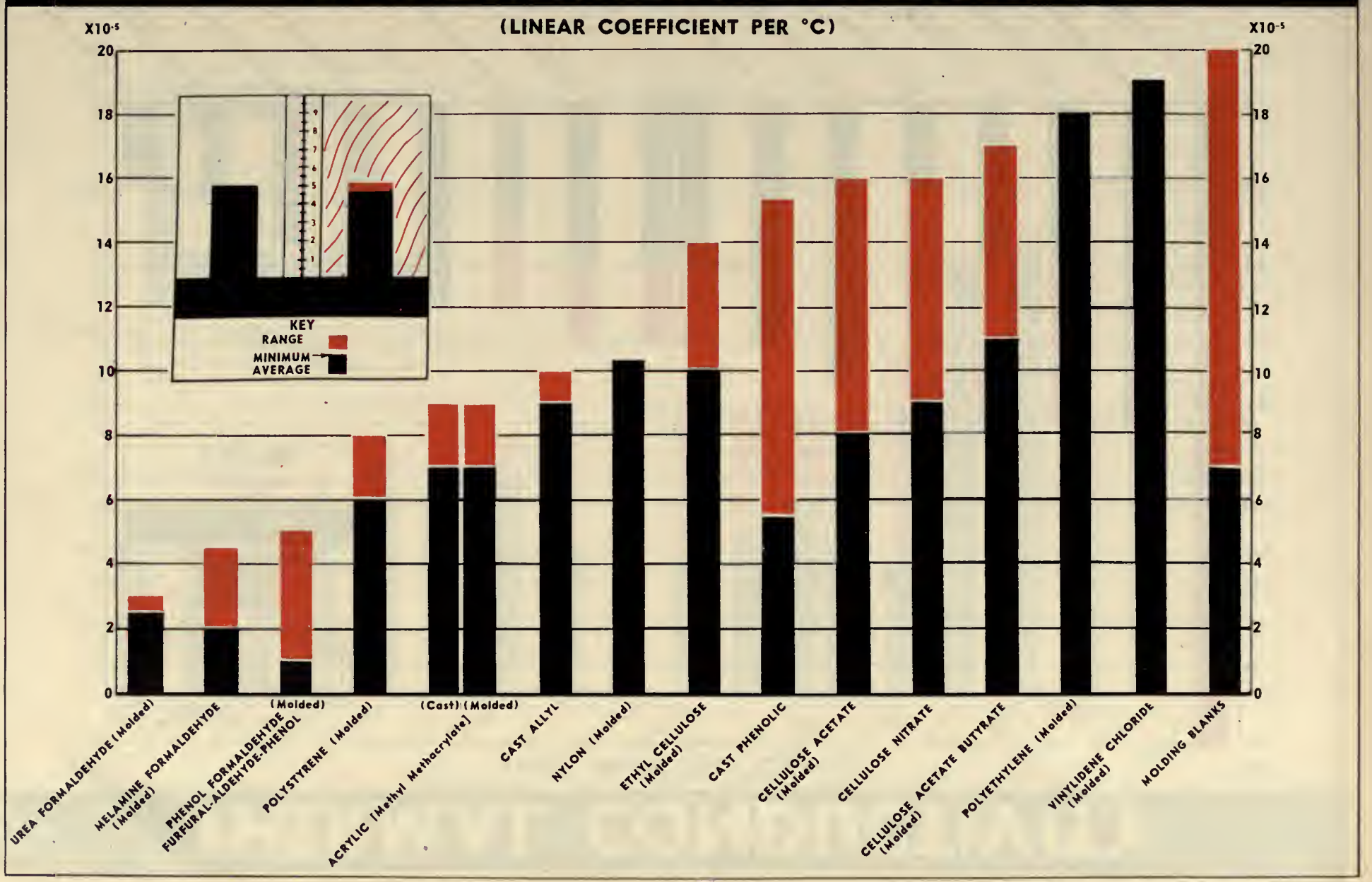
LAMINATED PHENOLIC TUBING
MELAMINE FORMALDEHYDE (Molded)
CELLULOSE ACETATE (Molded)
LAMINATED PHENOLIC — PLATE
MELAMINE LAMINATES (Molded)
PHENOL FORMALDEHYDE FURFURAL-ALDEHYDE-PHENOL
CAST PHENOLIC
* .00025-.0014

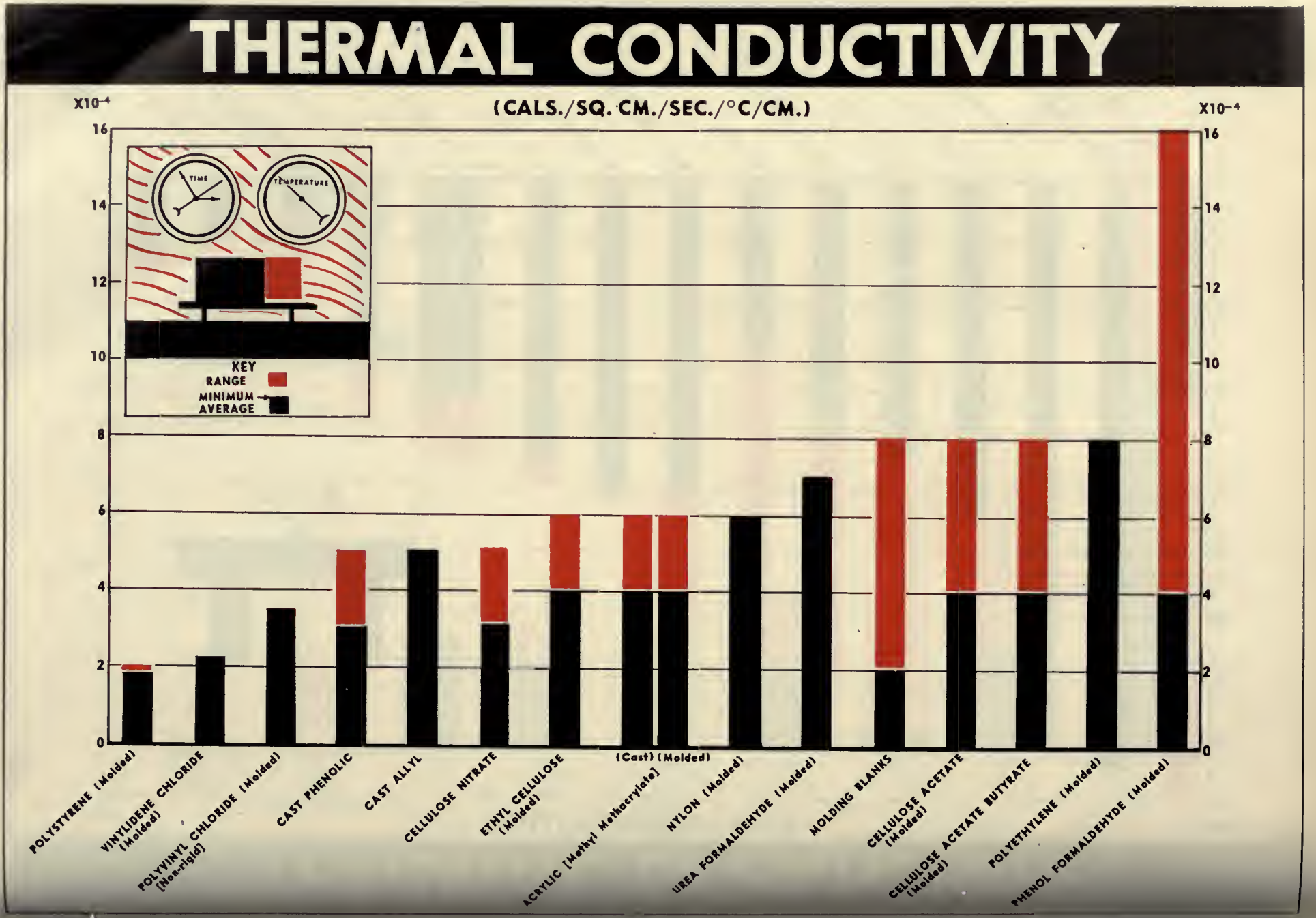
ARC RESISTANCE



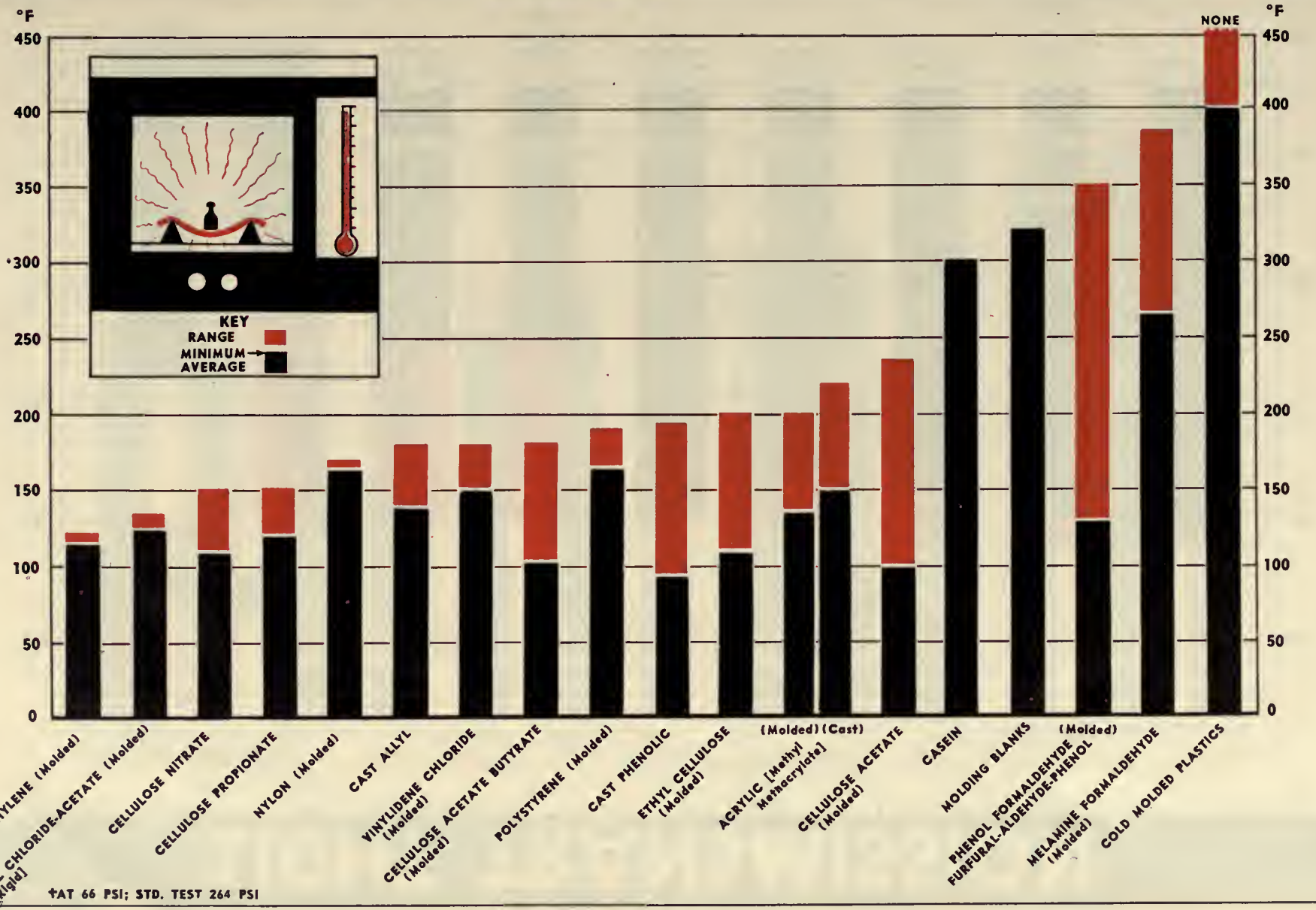
THERMAL EXPANSION



THERMAL CONDUCTIVITY

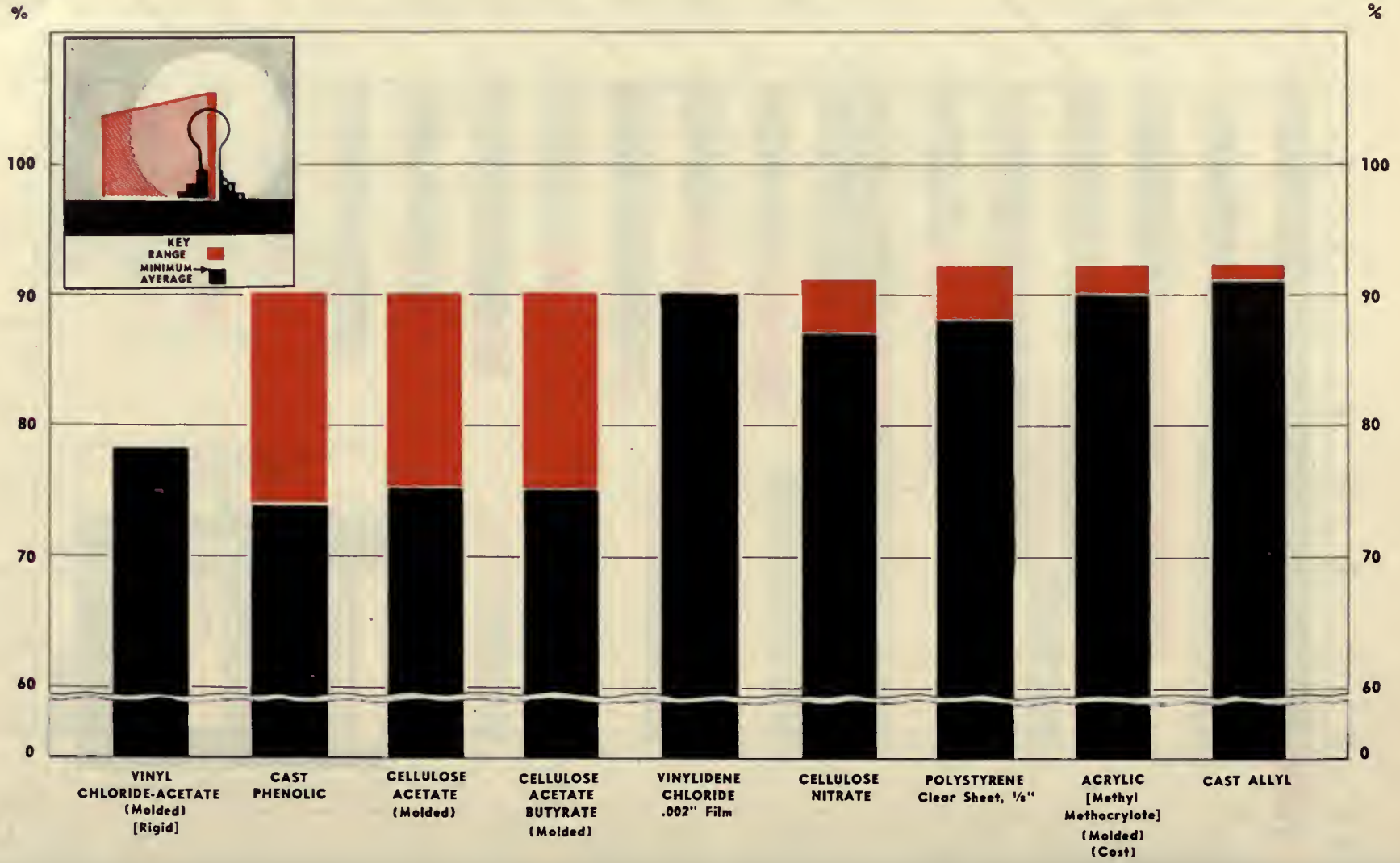


HEAT DISTORTION POINT

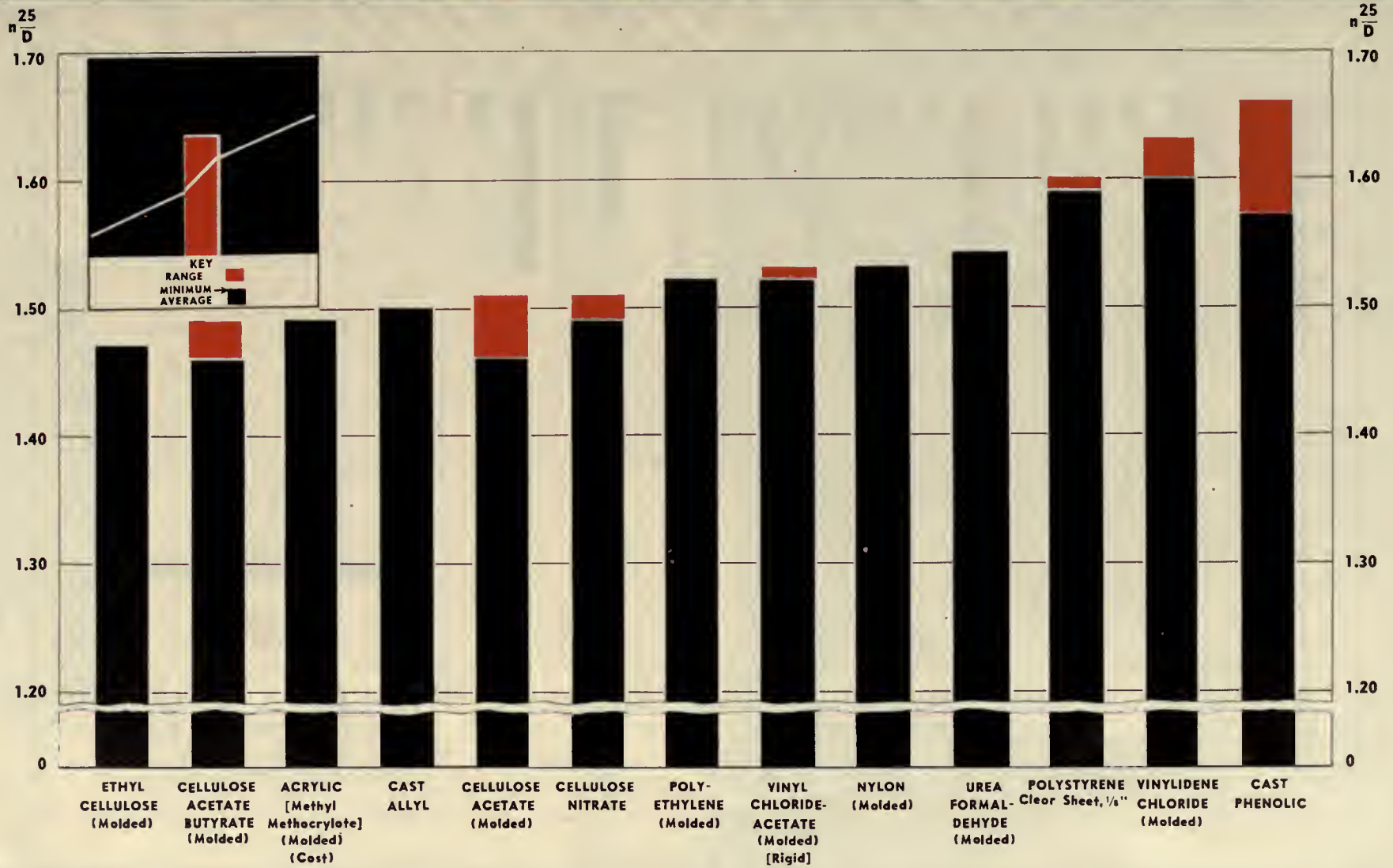


†AT 66 PSI; STD. TEST 264 PSI

LIGHT TRANSMISSION

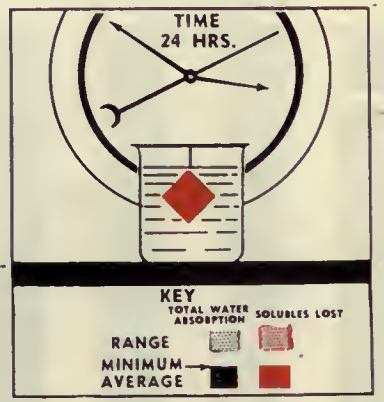


REFRACTIVE INDEX



WATER ABSORPTION

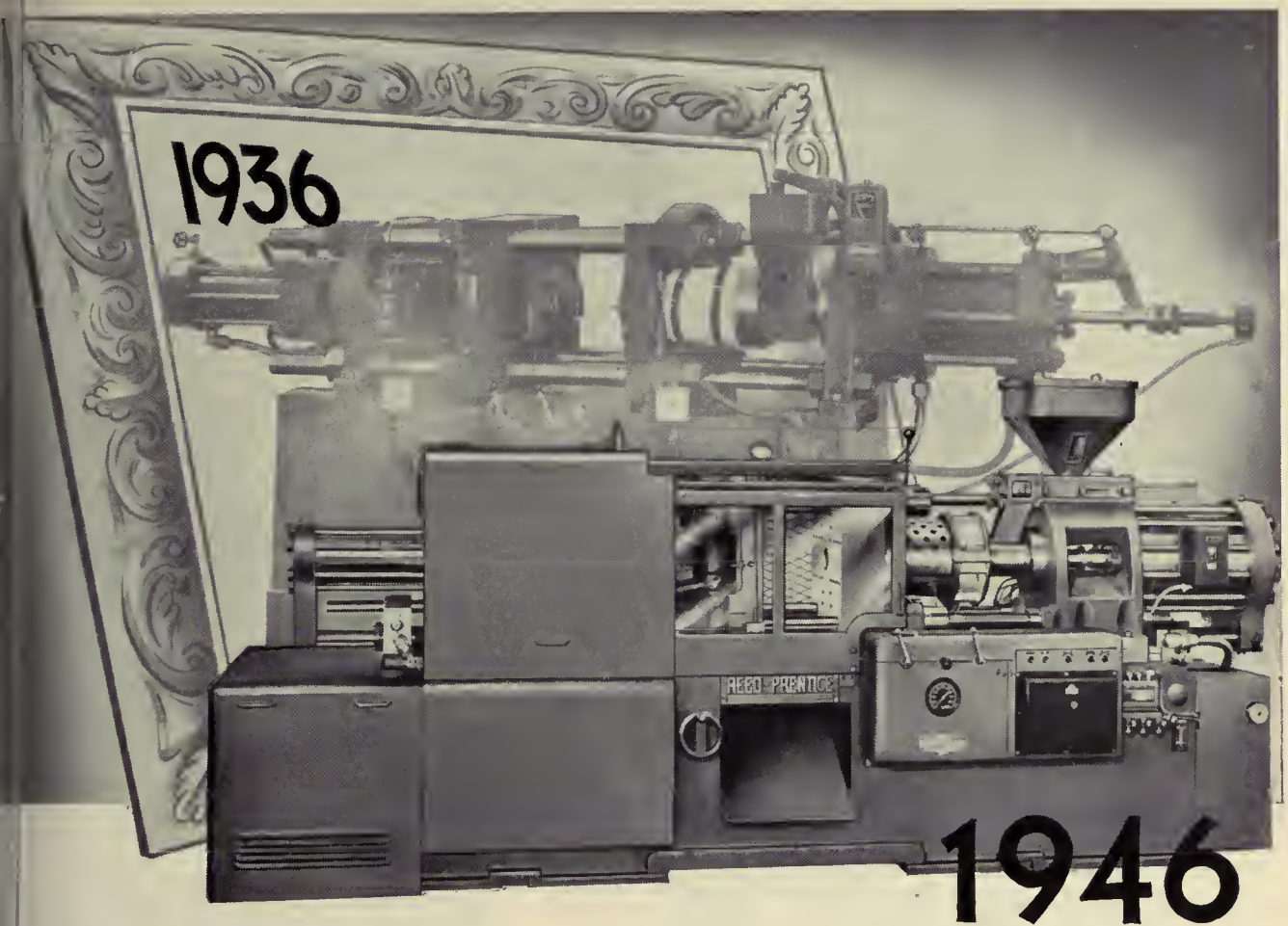
(AND SOLUBLES LOST)



%

6
5
4
3
2
1
0

POLYETHYLENE (Molded)
POLYSTYRENE (Molded)
VINYLIDENE CHLORIDE (Molded)
VINYL CHLORIDE-ACETATE (Molded) (Rigid)
CAST ALLYL (Molded) (Cast)
ACRYLIC (Methyl Methacrylate)
VINYL CHLORIDE-ACETATE (Molded) (Non-rigid)
MOLDING BLANKS
NYLON (Molded)
MELAMINE FORMALDEHYDE (Molded)
CELLULOSE PROPIONATE (Molded)
PHENOL FORMALDEHYDE FURFURAL-ALDEHYDE-PHENOL
UREA FORMALDEHYDE (Molded)
CAST PHENOLIC
ETHYL CELLULOSE (Molded)
POLYVINYL CHLORIDE (Molded) (Non-rigid)
RESIN FIBRES 48 Hr. Immersion
CELLULOSE ACETATE BUTYRATE
LAMINATED PHENOLIC-ROD
MELAMINE LAMINATES
LAMINATED PHENOLIC — PLATE
CELLULOSE NITRATE
LAMINATED PHENOLIC — TUBING
CELLULOSE ACETATE (Molded)



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We at Reed-Prentice are justly proud of the record of the first 1936 two ounce model, still in active service — a fore-runner of the largest selling line of plastic injection molding machines in the World.

To the molder, the 1946 model represents the ultimate in mass production, precision, safety and convenience, with a wide range of popular sizes available, including 22, 16, 12, 8, 6 and 4 ounce models.

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Tables of Properties

The accompanying tables of physical and chemical properties are designed to provide comparative values of the various plastics materials. (In the tables the trade name of each product is shown in italics, the producing company immediately following in parenthesis.) These tables cover typical—not all—grades in common use, but plastics can be formulated in an infinite number of ways to meet precise specifications. It should also be pointed out that most of the properties are determined under certain standard conditions while the product in use may be subjected to other conditions in which the "book value," so to speak, will not be valid. Furthermore, the manner in which the plastics material is molded or fabricated affects its properties. The values given are those supplied or approved by the materials manufacturers, and are assumed to be based on the best techniques now available.

CAST PLASTICS

PHENOL FORMALDEHYDES

General Purpose Grades

TYPE: Thermosetting.

OUTSTANDING QUALITIES: Lustre, colorability, shock and chemical resistance, low water absorption, non-flammability, dielectric strength, machinability.

TYPICAL USES: Ornaments, clock cases, furniture hardware, shoe buckles, radio cabinets, chemically resistant parts, games, brush backs, buttons; refrigerator, cutlery and other handles, toys.

BAKELITE CAST RESIN (Bakelite Corporation)

	BT-44-000 BT-45-000 BT-55-000 SERIES	BT-48-000 BT-58-000 SERIES
GENERAL PROPERTIES		
Specific gravity	1.30	1.30
Grams per cu. in.	21.2	21.2
MECHANICAL PROPERTIES		
Tensile strength (psi)	3,500—5,000	2,500—5,000
Compressive strength (psi)	7,000—10,000	7,000—10,000
Flexural strength (psi)	7,000—9,000	3,000—7,000
Impact strength (ft. lbs. per natch in.) (Izad)	0.30—0.40	0.35—0.45
Modulus of elasticity (psi $\times 10^6$)	0.25—0.40	0.25—0.40
Brinell hardness (5 mm ball)	20—30	15—20
ELECTRICAL PROPERTIES		
Volume resistivity (megahm cm)	1.0—10 $\times 10^5$	1—10 $\times 10^4$
Dielectric strength (.125 in. thick) (volts per mil)	200—250	175—200
Dielectric constant (60 cycles)	15.0—20.0	20.0—30.0
Dielectric constant (10^3 cycles)	12.0—18.0	12.0—15.0
Dielectric constant (10^6 cycles)	10.0—11.0	7.0—8.0
Power factor (60 cycles)	0.20—0.35	0.25—0.50
Power factor (10^3 cycles)	0.10—0.20	0.20—0.30
Power factor (10^6 cycles)	0.08—0.10	0.09—0.10

	8T-44-000 8T-45-000 8T-55-000 SERIES	8T-48-000 8T-58-000 SERIES
OPTICAL PROPERTIES		
Refractive index	———	1.615—1.62
Light transmission (%)	5—50	80—90
Color range—8T-44-000	Opaque, White, Ivory	
8T-45-000	Transiucent, Solid Colors	
BT-55-000	Mattled, Translucent	
8T-48-000	Transparent	
BT-58-000	Mattled Transparencies	
THERMAL PROPERTIES		
Thermal expansian (°C $\times 10^{-6}$)	150—160	125—130
Distortian under heat (°C)	40—45	35—45
STABILITY		
Water absorption (% after immersian 48 hrs.)	———	0.015—0.60
FABRICATING DATA		
Machining qualities	Excellent	Excellent

EFFECTS OF CHEMICALS

Decampased by strang oxidizing acids and alkalies; reacts slightly with same weak acids, strang reducing and arganic acids.

CATALIN (Catalin Corporation)

Available in sheet, rad, tube, cast shapes.

GENERAL PROPERTIES

Specific gravity	1.315—1.335
Grams per cu. in.	21.5—21.8
Odar	None
Taste	Nane

MECHANICAL PROPERTIES

Tensile strength (psi)	5,000—9,000
Compressive strength (psi)	14,000—20,000
Flexural strength (psi)	6,000—9,000
Shear strength (psi)	4,000—6,000
Impact strength (ft. lbs. per in. natch) (Izad)	0.30—0.40

OPTICAL PROPERTIES

Refractive index, N/D	1.58—1.61
Light transmissian (%)	0—5
Color range	Unlimited

FABRICATING DATA

Machining qualities	Excellent

ELECTRICAL PROPERTIES

Volume resistivity (ahms cm.)	(1-10) $\times 10^{13}$
Dielectric strength (volts per mil) shart time	300—400
stepwise	200—350
Dielectric canstant (60 cycles)	15—20
Dielectric constant (10^3 cycles)	12—18
Dielectric constant (10^6 cycles)	5—11
Pawer factar (60 cycles)	0.025—0.2
Power foctor (10^3 cycles)	0.1—0.2
Pawer factar (10^6 cycles)	0.01—0.10
Loss factar (60 cycles)	2.5—2.75

STABILITY

Water absarptian (% after immersian 24 hrs.)	0.5—2.0
Effect af age	Hardens and Yellows
Effect of sunlight	Hardens and Yellows

THERMAL PROPERTIES

Distortian under heat (°F)	104—140
Burning rate	Nan-flammable

EFFECT OF CHEMICALS

Reacts slightly to weak acids; inert to weak alkalies; decompases in strong acids and alkalies; reacts with some arganic salvents.

IT HAS TO BE FAST TO GRIND PLASTICS

CINCINNATI

INCINNATI No. 2 Centerless Grinding Machine. Catalog G-456-2 contains complete specifications. For a brief description of the Centerless Machines, look in Sweet's Catalog File for Mechanical Industries.

Grinding plastic tubes on o CINCINNATI No. 2 Centerless Grinder. Stock removol .050" to .075", at a production rote of well over 100" per minute.

● You can't afford to spend a lot of time or money machining plastics, and that's why CINCINNATI Centerless Grinders fit so well in the production of such parts. These machines are used extensively for grinding operations on plastic pool balls, electrical insulators, bowling balls; tubes and rods of various diameters and lengths. Stock removal may vary anywhere from a fine finish of a few thousandths to a rough grind of rounding up square bars. The centerless method is ideal for grinding a wide range of parts made from plastics and other nonmetallic materials. ¶ Talk over your grinding problems with Cincinnati Application Engineers. They will be glad to give you the benefit of their 20 years of experience in improving centerless grinding procedure.

CINCINNATI GRINDERS INCORPORATED

CINCINNATI 9, OHIO, U.S.A.

CENTER TYPE GRINDING MACHINES · CENTERLESS GRINDING MACHINES · CENTERLESS LAPPING MACHINES

MARBLETTE (The Marblette Corporation)

Available in sheets, rods, tubes, etc.

GENERAL PROPERTIES

Specific gravity	1.30—1.32
Grams per cu. in.	21.8

MECHANICAL PROPERTIES

Tensile strength (psi)	8,000—12,000
Compressive strength (psi)	15,000—30,000
Impact strength (ft. lbs. per notch in.) (Izod)	0.40—0.50
Modulus of elasticity (psi × 10^5)	4

ELECTRICAL PROPERTIES

Volume resistivity (ohms cms)	10^{12}—10^{13}
Dielectric constant (10^6 cycles)	5—7
Power factor (60 cycles)	0.10—0.15

OPTICAL PROPERTIES

Refractive index, N/D	1.5—1.7
Color range	Unlimited

THERMAL PROPERTIES [Cast Plastics] Cont.

Thermal conductivity (10^{-4} cal. sec., cm. °C)	3—5
Specific heat (cal. per °C per gram)	0.3—0.4
Thermal expansion (per °C × 10^5)	8—11
Distortion under heat (°F)	170
Burning rate	Non-flammable

STABILITY

Water absorption (% after immersion 48 hrs.)	0.4—0.6
Effect of age	Hardens and Yellows

FABRICATING DATA

Machining qualities	Excellent

EFFECT OF CHEMICALS

Not affected by weak acids; slightly or not at all affected by strong reducing and organic acids, decomposed by strong alkalies and strong oxidizing acids.

PRYSTAL (Catalin Corporation)

OUTSTANDING QUALITIES: High transparency, colorability.

TYPICAL USES: Handbag frames, jewelry, buttons, displays, novelties, engineering dials.

Available in fully cured shapes.

GENERAL PROPERTIES

Specific gravity	1.30—1.335
Specific volume (ozs. per cu. in.)	0.766

MECHANICAL PROPERTIES

Tensile strength (psi)	3,000—5,000
Compressive strength (psi)	4,000—7,000
Flexural strength (psi)	2,950
Impact strength (ft. lbs. per notch in.) (Izod)	0.30—0.45
(Charpy)	0.26—0.31
Modulus of elasticity (psi × 10^5)	1.25—4
Shear strength (psi) (for 1" dia. plunger)	3,000—4,000
Rockwell hardness	M30—M40

FABRICATING DATA

Machining qualities	Excellent

EFFECT OF CHEMICALS

Slightly or not affected by weak acids; slightly to markedly affected by weak alkalies; decomposed by strong oxidizing acids; not affected or slightly affected by reducing and organic acids.

ELECTRICAL PROPERTIES

Volume resistivity (ohms cms)	1—10 × 10^4
Dielectric strength (volts per mil)	76—98
Dielectric constant (60 cycles)	20—30
Dielectric constant (10^3 cycles)	12—15
Dielectric constant (10^6 cycles)	7—8
Power factor (60 cycles)	0.25—0.50
Power factor (10^3 cycles)	0.20—0.30
Power factor (10^6 cycles)	0.09—0.10

OPTICAL PROPERTIES

Refractive index, N/D	1.59—1.62
Light transmission (%)	80—90
Color range	Unlimited

THERMAL PROPERTIES

Thermal expansion (per °C × 10^{-5})	8.3—13
Distortion under heat (°F)	95—113
Burning rate	Non-flammable

STABILITY

Tendency to cold flow	None
Water absorption (% after immersion 24 hrs.)	0.5—3.0
Effect of age	Hardens and Yellows
Effect of sunlight	Yellows

Special Purpose Grades

BAKELITE CAST RESIN (Bakelite Corporation)

OUTSTANDING QUALITIES: Chemical resistance, good electrical properties. In addition, Grade BT-41-001 has good dimensional stability; Grade BT-43-001, high heat distortion and greater hardness than some of the other grades.

TYPICAL USES: Grade 41-001: Electrical and chemical purposes; Grade 43-001, specific applications.

Available in rods, sheets, tubes.

	BT-41-001 SERIES	BT-43-001 SERIES
GENERAL PROPERTIES		
Specific gravity	1.26	1.26
MECHANICAL PROPERTIES		
Tensile strength (psi)	6,950—7,400	5,000—7,000
Compressive strength (psi)	13,000—18,000	20,000—25,000
Flexural strength (psi)	9,000—14,000	9,000—14,000
Impact strength (ft. lbs. per notch in.) (Izod)	0.30—.40	0.250—0.330
Modulus of elasticity (psi × 10^6)	0.4—0.5	0.5—0.65
Brinell hardness (5 mm ball)	35—40	35—40
THERMAL PROPERTIES		
Coefficient of expansion (°C × 10^{-6})	105—115	80—90
Distortion under heat (°C)	55—65	65—75
EFFECTS OF CHEMICALS		
Decomposed by strong oxidizing acids and alkalies, reacts slightly with some weak acids, strong reducing and organic acids.		

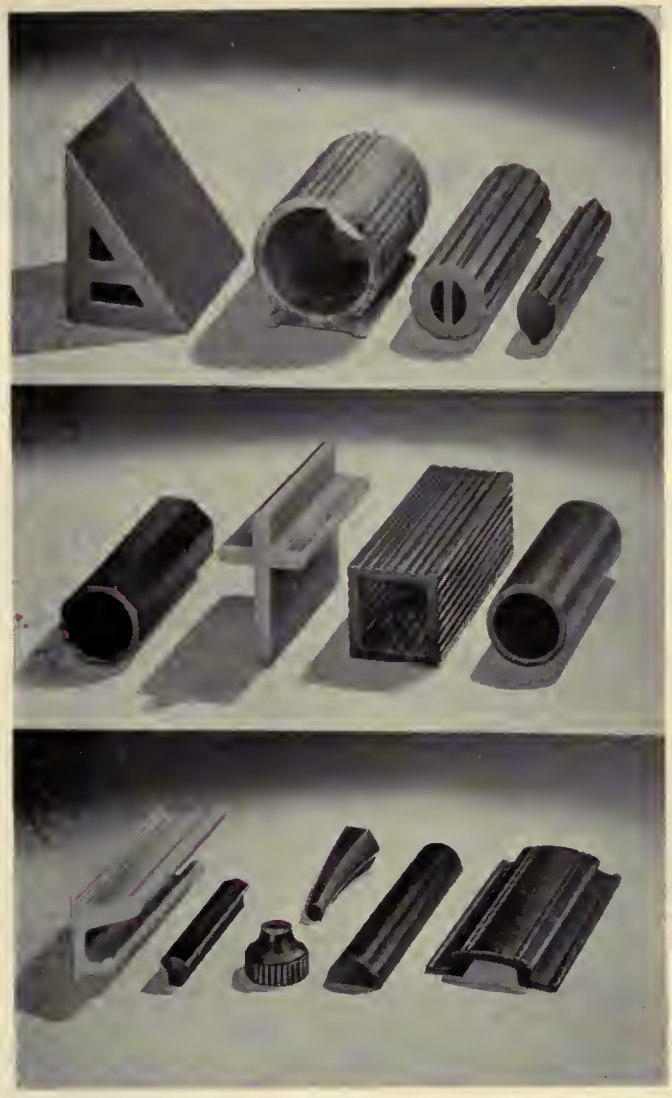
ELECTRICAL PROPERTIES	BT-41-001 SERIES	BT-43-001 SERIES
Volume resistivity (ohms cms.)	(1.0—10) × 10^5	(1.0—10) × 10^7
Dielectric strength (.125 in. thick) (volts per mil)	275—300	275—300
Dielectric constant (60 cycles)	7.0—8.0	5.0—5.5
Dielectric constant (10^3 cycles)	6.0—7.0	5.0—5.5
Dielectric constant (10^6 cycles)	5.5—6.0	4.7—4.9
Power factor (60 cycles)	0.10—0.15	0.010—0.015
Power factor (10^3 cycles)	0.03—0.04	0.010—0.015
Power factor (10^6 cycles)	0.04—0.05	0.03—0.04
OPTICAL PROPERTIES		
Refroctive Index	1.65—1.66	1.65—1.66
Light transmission (%)	65—75	65—75
Color range	Transparent Amber	Transparent Amber
FABRICATING DATA		
Machining qualities	Excellent	Excellent
STABILITY		
Water absorption (% after immersion 48 hrs.)	0.40—0.60	0.40—0.60

MARBLETTE

THE *Versatile* PLASTIC

A CAST PHENOLIC RESIN OF EXCEPTIONAL QUALITIES

- Outstanding among plastics, Marblette has a jewel-like depth and a complete color range which duplicates the appearance of precious stones, tortoise shell and ivory.
- Its almost infinite variety of colors is available in transparent, translucent, opaque, or in mottled effects. Marblette also comes in a waterclear form known as "Crystle" in a wide choice of colors.
- Marblette's machining characteristics, resistance to oil and acids, non-inflammability and exciting beauty make it ideal for countless manufacturing needs.



A few of the many types of Special Marblette castings made to customer's specifications.

SPECIAL CASTINGS

Marblette is supplied in sheets, rods, tubes, and special castings such as cutlery handles, kitchen utensil handles, pipe stems, cigarette holders, clock cases, automotive trimmings, jewelry items, buckles, etc. Special shapes made to customer's specifications can be supplied provided draft is all one way.

MARBLETTE LIQUID PHENOLIC RESINS

Casting Resins for Forming Dies and Tools

Metal Casting Sealing Resins

Bonding Resins

Low Pressure Laminating Resin

Bristle Setting Cement

Laminating and Insulating Varnish

Clear Phenolic Lacquer

MARBLETTE WILL HELP PLAN YOUR WORLD OF TOMORROW

The Marblette staff of engineers offers its services to help with your manufacturing problems. Write to us outlining your needs.

THE MARBLETTE CORPORATION

Manufacturers of Phenolic Resins Since 1929

37-21 Thirtieth St., Long Island City 1, N. Y.

BAKELITE CAST RESIN (Bakelite Corporation)

OUTSTANDING QUALITIES: Dielectric strength, high heat distortion, low water absorption, excellent light transmission.
TYPICAL USES: Models for quantitative photo-elastic stress analysis.

Available in plates only.

GENERAL PROPERTIES	BT-61-893 SERIES
Specific gravity	1.40
Grams per cu. in.	22.9
MECHANICAL PROPERTIES	
Tensile strength (psi)	8,500—10,500
Compressive strength (psi)	20,000—30,000
Flexural strength (psi)	10,000—15,000
Impact strength (ft. lbs. per notch in.) (Izod)	0.450—0.550
Modulus of elasticity (psi × 10^6)	0.55—0.65
Brinell hardness (5 mm ball)	40—50
THERMAL PROPERTIES	
Coefficient of expansion (°C × 10^{-6})	55—60
Distortion under heat (°C)	80—90
EFFECT OF CHEMICALS	
Decomposed by strong oxidizing acids and alkalies, reacts slightly with some weak acids, strong reducing and organic acids.	

ELECTRICAL PROPERTIES	BT-61-893 SERIES
Volume resistivity (ohms cms.)	Over 10^8
Dielectric strength (.125 in. thick) (volts per mil)	300—350
Dielectric constant (60 cycles)	4.0—4.5
Dielectric constant (10^3 cycles)	4.0—4.5
Dielectric constant (10^6 cycles)	3.7—4.0
Power factor (60 cycles)	0.003—0.004
Power factor (10^3 cycles)	0.006—0.008
Power factor (10^6 cycles)	0.025—0.035
OPTICAL PROPERTIES	
Refractive index	1.5736—1.5739
Light transmission (%)	88.8—90
Color range	Water White Transparent
STABILITY	
Water absorption (% after immersion 48 hrs.)	0.10—0.15
FABRICATING DATA	
Machining qualities	Excellent

Electrical and Mechanical Grades

CATALIN (Catalin Corporation)

Available in sheet, rod, tube.

GENERAL PROPERTIES	
Specific gravity	1.305—1.315
Grams per cu. in.	21.29—21.47
Odor	Odorless
Taste	Tasteless
MECHANICAL PROPERTIES	
Tensile strength (psi)	8,500—10,000
Compressive strength (psi)	20,000—25,000
Flexural strength (psi)	10,000—12,000
Impact strength (ft. lbs. per notch in.) (Izod)	0.48—0.60
Modulus of elasticity (psi × 10^5)	3.75
Rockwell hardness	M65—M80
STABILITY	
Tendency to cold flow	None
Water absorption (% after immersion 24 hrs.)	0.4—0.6
Effect of age	Hardens and Yellows
Effect of sunlight	Yellows
FABRICATING DATA	
Machining qualities	Excellent

ELECTRICAL PROPERTIES	
Volume resistivity (ohms cms.)	17 × 10^{12}
Dielectric strength (volts per mil) short time	350—430
stepwise	260—335
Dielectric constant (60 cycles)	6.5—7.5
Dielectric constant (10^3 cycles)	5.5—6.0
Dielectric constant (10^6 cycles)	7.4
Power factor (60 cycles)	0.10—0.15
Power factor (10^3 cycles)	0.01—0.05
Power factor (10^6 cycles)	0.02—0.05
OPTICAL PROPERTIES	
Refractive Index, N/D	1.59—1.61
Light transmission (%)	0—1
Color range	White
THERMAL PROPERTIES	
Thermal conductivity (10^{-5} cal. sec., cm. °C)	3—5
Thermal expansion (per °C × 10^{-5})	8.1—10.9
Distortion under heat (°F)	113—176
Burning rate	Non-flammable
EFFECT OF CHEMICALS	
Decomposed by strong oxidizing acids and alkalies; reacts slightly with some weak acids, strong reducing and organic acids.	

COLD MOLDED PLASTICS

Non-Refractory Types

TYPE: Becomes thermoplastic or thermosetting, not during molding, but during subsequent baking.
OUTSTANDING QUALITIES: Heat and arc resistance, low cost, high production rate.
TYPICAL USES: Handles, knobs, switch bases, wiring-device parts, with bases, conduit outlets, receptacles, adapters.

AICO (American Insulator Corporation)

Available in molded shapes and forms.

GENERAL PROPERTIES	GRADES 1, 6
Specific gravity	1.87—2.2
Grams per cu. in.	33
MECHANICAL PROPERTIES	
Tensile strength (psi)	1,300—3,000
Compressive strength (psi)	6,000—15,000
Flexural strength (psi)	3,000—9,000
Impact strength (ft. lb. per notch in.) (Izod)	0.3—.04
Modulus of elasticity (psi × 10^5)	20
Rockwell hardness	M35—M80
ELECTRICAL PROPERTIES	
Volume resistivity (ohms cms × 10^{12})	1.3
Dielectric strength (volts per mil)	40—90
Dielectric constant (60 cycles)	15
Dielectric constant (10^6 cycles)	6
Power factor (60 cycles)	0.20
Power factor (10^6 cycles)	0.07

OPTICAL PROPERTIES	GRADES 1, 6
Color range	Black, Brown, Red
THERMAL PROPERTIES	
Top operating temperature (°F)	500
Burning rate	None
STABILITY	
Tendency to cold flow	None
Water absorption (% after immersion 24 hrs.)	0.6—2
Effect of age	None
Effect of sunlight	None
FABRICATING AND MOLDING DATA	
Molding qualities	Good
Molding methods	Compression
Machining qualities	Poor
Effect on metal inserts	None
EFFECT OF CHEMICALS	
Decomposes in strong acids, alkalies; weak alkalies have no effect.	

UMMON (Garfield Manufacturing Company)

Avoilable in molded form only.

ENERAL PROPERTIES

Specific gravity	1.87—2.15
Grams per cu. in.	14.8—12.9

ECHANICAL PROPERTIES

Compressive strength (psi)	6,000—15,000
Flexurol strength (psi)	3,700—9,300
Impoct strength (ft. lbs. per notch in.) (Izod)	0.4
Rockwell hordness	M35—M65

PTICAL PROPERTIES

Light transmission (%)	Opoque
Color range	Dark Coiors Only

IERMAL PROPERTIES

Top operating temperoture (°F)	500
Burning rate	Non-flammoble

ELECTRICAL PROPERTIES **[Cold Molded] Cont.**

Volume resistivity (ohms cms)	1.3×10^{12}
Dielectric strength (volts per mil) short time	85
stepwise	50—75
Dielectric constant (60 cycles)	15.0
Dielectric constont (10^6 cycles)	6.0
Power factor (60 cycles)	0.20
Power factor (10^6 cycles)	0.07

STABILITY

Water obsorption (% ofter immersion 24 hrs.)	0.6—2.0

FABRICATING AND MOLDING DATA

Molding qualities	Foir to Good
Molding methods	Cold
Machining qualities	Poor
Effect on metoi inserts	inert

EFFECT OF CHEMICALS

Reocts slightiy to weak acids; inert to weok olkalies; decomposes in strong ocids ond alkaiies; reacts with some organic solvents.

EXTOLITE (General Electric Company, Plastics Div.)

Avoilable in molded ports.

ENERAL PROPERTIES GRADE 74

Specific gravity	2.0

ECHANICAL PROPERTIES

Compressive strength (psi)	12,000—20,000
Flexural strength (psi)	3,000—6,500
Impact strength (ft. lbs. per notch in.) (Izod)	0.35—0.50
Modulus of eiasticity (psi $\times 10^5$)	20
Rockwell hardness	M75—M80

HERMAL PROPERTIES

Thermol exponsion (per °C $\times 10^{-5}$)	1.4
Top operating temperoture (°F)	400
Softening point (°F)	None
Distortion under heat (°F)	+400
Burning rate	Very Low

ELECTRICAL PROPERTIES GRADE 74

Dielectric strength (volts per mii) ¼" thk., 25 °C stepwise	40—80

OPTICAL PROPERTIES

Color range	Black, Brown

STABILITY

Tendency to cold flow	None
Woter absorption (% ofter immersion 48 hrs.)	2—4
Effect of oge	None
Effect of sunlight	None

FABRICATING AND MOLDING DATA

Molding qualities	Ports somewhat limited in intricocy
Molding methods	Compression
Mochining qualities	Foir
Effect on metoi inserts	Certain types ore corrosive

EFFECT OF CHEMICALS

insoluble in most soivents; resistont to water, minerai oils, weok ocids; ottocked by olkolies ond strong ocids.

Refractory Types

TYPE: Cold molded (thermosetting after baking).

OUTSTANDING QUALITIES: Heat, flame and arc resistance; strength.

TYPICAL USES: Third rail insulators, arc shields, heavy duty switch bases, electrical switch bases and plugs, connector plugs, handles and knobs, resistor plates, fuse blocks, heaters and flat irons, switch parts.

EXTOLITE (General Electric Company, Plastics Div.)

Available in molded ports.

ENERAL PROPERTIES GRADE 94*

Specific gravity	2.0—2.2

ECHANICAL PROPERTIES

Compressive strength (psi)	16—20,000
Flexural strength	3,000—6,000
Impact strength (ft. lbs. per notch in.) (Izod)	0.50—0.60
Modulus of elosticity (psi $\times 10^5$)	30
Rockwell hardness	80—90

LECTRICAL PROPERTIES

Dielectric strength (volts per mii)	Variable
Dielectric constont (60 cycles)	Note 1
Dielectric constont (10^3 cycles)	Note 1
Dielectric constont (10^6 cycles)	Note 1

OPTICAL PROPERTIES

Color range	Gray

THERMAL PROPERTIES

Thermol exponsion (per °C $\times 10^{-5}$)	0.8
Top operoting temperature (°F) (Note 2)	700
Softening point (°F)	+2200
Distortion under heot (°F)	None
Burning rate	None

STABILITY

Tendency to flow cold	None
Woter absorption (% after immersion 48 hrs.)	12—15
Effect of oge	Improves
Effect of sunlight	None

FABRICATING AND MOLDING DATA

Moiding quoiities	Good
Molding methods oppiicoble	Compression
Machining qualities	Foir
Effect on metol inserts	None

EFFECT OF CHEMICALS

Insoiuble in oil organic soivents; resistont to woter, oils, most solvents and olkoiies; ottacked by ocids.

Also available are impregnated grades 94-C (gray) and 94-D (black) which are waterproof and, therefare, have better dielectric strength (heat resistance is limited by impregnant).

Nate 1: These tests unnecessary because af the water absarptive properties af this material. Nate 2: Certain portians af arc barriers reach a much higher temperature.

AICO (American Insulator Corporation)

Available in molded shapes and forms.

GENERAL PROPERTIES	GRADE 5
Specific gravity	1.87—2.2
Grams per cu. in.	33
Odor	None
Taste	None
MECHANICAL PROPERTIES	
Compressive strength (psi)	6,000—15,000
Flexural strength (psi)	3,000—9,000
Impact strength (ft. lb. per notch in.) (Izod)	0.3—0.4
Modulus of elasticity (psi × 10^5)	30
Rockwell hardness	M80—M90
OPTICAL PROPERTIES	
Color range	Grey
THERMAL PROPERTIES	
Top operating temperature (°F)	1,000
STABILITY	
Water absorption (% after immersion 24 hrs.)	0.5—15
Effect of age	None
Effect of sunlight	None
FABRICATING AND MOLDING DATA	
Molding qualities	Fair
Molding methods	Compression
Machining qualities	Poor
Effect on metal inserts	None
EFFECT OF CHEMICALS	
Decomposes in strong acids; alkalies have no effect.	

LAMINATED PLASTICS

There is a wide variation of possible values for the laminated plastics. By making the "sandwich" material paper, fine or coarse-woven cotton, asbestos or glass fibre and varying the nature and amount of the resin binder, laminates can be formulated to numbers of specifications. There are, however, certain grades which have been standardized according to specifications of the National Association of Electrical Manufacturers (NEMA), and most laminators meet or surpass these specifications. Grades LE, XXP, etc., in the tables which follow are NEMA designations of standard grades; special grades are so indicated. These tables are, of course, merely typical of grades available in the trade generally—every laminator produces a variety of grades.

The companies whose names appear after the trade names are the manufacturers of the laminates. The producers of the resin binders are listed in the index to the directory section under "Laminating, Impregnating, Coating Materials."

ALLYL ALCOHOLS

TYPE: Thermosetting.
OUTSTANDING QUALITIES: High strength-weight ratio, abrasion resistance, ease of forming.
TYPICAL USES: Aircraft fairings, fuel and other tanks, wing tips, doors; first aid kits.

MARCO-LITE (Continental Can Company, Inc.)

Available in sheet.

GENERAL PROPERTIES	FIBERGLAS COARSE-WEAVE CROSSED	FIBERGLAS FINE-WEAVE CROSSED
Specific gravity	1.66—1.80	1.70—1.80
Grams per cu. in.	27.1—29.4	26.2—29.4
MECHANICAL PROPERTIES		
Tensile strength	30,000—40,000	35,000—45,000
Compressive strength (psi)	60,000—70,000	58,000
Flexural strength (psi)	30,000—40,000	38,000
Impact strength (ft. lbs. per notch in. Izod)	30—50	25
Modulus of elasticity (psi × 10^5)	1,750,000	2,000,000—2,300,000
Elongation (%)	2.9	2.5
Shear strength	18,000	20,000
Rockwell hardness	M110	M110
THERMAL PROPERTIES		
Thermal expansion (10^{-5} per °C)	1.3—2.2	1.0—2.6
Distortion under heat (°F)	320	320
Burning rate (per in.)	0.36	0.3
STABILITY		
Water absorption	0.3—0.6	0.3—0.6

GENERAL PROPERTIES	COTTON 4-OZ. MUSLIN CROSSED	PAPER KRAFT CROSSED
Specific gravity	1.40—1.48	1.4
Grams per cu. in.	22.6—24.2	22.6
MECHANICAL PROPERTIES		
Tensile strength (psi)	8,500—12,000	13,000
Compressive strength (psi)	32,000	34,000
Flexural strength (psi)	20,000	19,000
Impact strength (ft. lbs. per notch in. Izod)	2.9—3.4	0.9—1.0
Modulus of elasticity (psi × 10^5)	1,000,000	1,000,000
Elongation (%)	3.7—5.0	2.2
Shear strength (psi)	12,000	11,000
Rockwell hardness	M92	M93
STABILITY		
Water absorption	0.5—1.2	3.0—5.0
THERMAL PROPERTIES		
Burning rate (per in.)	0.44	0.35
FABRICATING DATA		
Machining qualities	Good	

ORLD'S LARGEST PRODUCER OF SYNTHETIC RESINS

RCI

PLYOPHENS

clip precious minutes

from laminate production

omewhere in the large family of Plyophen phenolic esins and varnishes you'll find one exactly suited to our production operation. And when you do you'll ave a *find* indeed because Plyophens are outstanding in the very things you need to spur production of quality laminates. Plyophens are exceptional in curing speed. Surprisingly low pressures are required. And their binding properties are all you could require. Write direct to the sales department for a complete list of versatile, useful Plyophens.

REICHHOLD CHEMICALS, INC.

General Offices and Main Plant, Detroit 20, Michigan

Other Plants:
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SYNTHETIC RESINS • CHEMICAL COLORS • PHENOLIC PLASTICS • INDUSTRIAL CHEMICALS

ANILINE FORMALDEHYDES

TYPE: Thermosetting.
OUTSTANDING QUALITIES: Electrical stability, high dielectric strength, resistance to moisture, good mechanical strength.
TYPICAL USES: Coil forms, jack pile-ups, antenna housings, stator insulation, terminal blocks.

DILECTENE (Continental-Diamond Fibre Co.)

Available in sheet, rod.

GENERAL PROPERTIES

Specific gravity	1.21
Grams per cu. in.	20.7

MECHANICAL PROPERTIES

Tensile strength (psi)	10,000
Compressive strength (psi)	20,000
Flexural strength (psi)	18,000
Impact strength (ft. lbs. per notch in.) (Izod)	0.35
Maduius of elasticity (psi × 10^5)	6.5
Rockwell hardness	M115

ELECTRICAL PROPERTIES

Dielectric strength (volts per mil, 80 °F) short time	600
stepwise	400

THERMAL PROPERTIES

Thermal expansian (per °F × 10^{-6})	30
Distortion under heat (°F)	210
Burning rate	Non-flammable

STABILITY

Tendency to cald flaw	Slight
Water absarption (% after immersian 24 hrs.)	0.08
Effect af age	None
Effect of sunlight	None

FABRICATING DATA

Machining qualities	Gaad

EFFECT OF CHEMICALS

Slightly attacked by weak acids; decomposed by strong acids; unaffected by sodium hydroxide up to 25%; insoluble in comman organic saivents; resistant to aromatic hydrocarbans and alcohols.

LIGNINS

TYPE: Thermoplastic.
OUTSTANDING QUALITIES: High dielectric strength, arc resistance and strength-weight ratio, low moisture absorption.
TYPICAL USES: Switchboards, terminal blocks, electrical insulation forms, templates, foundry pattern plates, name plates.

LIGNOLITE (Marathon Corp., Chemical Div.)

Available in sheet.

GENERAL PROPERTIES — GRADE NO. 130

Specific gravity	1.40
Grams per cu. in.	22.65
Odar	Slight adar when hot

MECHANICAL PROPERTIES

Tensile strength (psi)	7,500—12,000
Compressive strength (psi)	25,000—35,000
Flexural strength (psi)	16,000—20,000
Impact strength (ft. lbs. per notch in.) (Izad)	1.6—1.8
Rockwell hardness	M104

THERMAL PROPERTIES

Expansion (in./in./°C × 10^{-6})	17.3
Distartian under heat (°F)	158
Burning rate	Very Slow
Top operating temperature (°F)	158

STABILITY

Water absarption, ⅛" thick (% after immersian 24 hrs.)	2.5
Effect of sunlight	Bleach

ELECTRICAL PROPERTIES — GRADE NO. 130

Dielectric strength (volts per mil) short time,	⅟₁₆ in.	700—900
	⅛ in.	550—700
	¼ in.	500—700
stepwise,	⅟₁₆ in.	450—650
Dielectric strength (volts per mil)	⅛ in.	550—600
	¼ in.	350—500
Dielectric constant (10^6 cycles)		4.80
Power factor (10^6 cycles)		0.037

FABRICATING AND MOLDING DATA

Molding qualities	Good
Molding methads	Campression, Laminating
Machining qualities	Good
Effect on metal inserts	None

EFFECT OF CHEMICALS

Decomposed by strong alkalies and strong oxidizing acids; slight to no reaction to weak acids; reaction to different weak alkalies varies; reacts to alcohols and esters. Resistant to mineral ails and hydracarbon saivents.

MELAMINE FORMALDEHYDES

TYPE: Thermosetting.
OUTSTANDING QUALITIES: Toughness, mechanical strength; flame and heat resistance, moisture resistance and arc resistance; excellent resistance to fungi.
TYPICAL USES: Kickplates, bar tops, table tops, nameplates, signboards, display boards, panel boards, insulation parts; circuit breaker and switchboard panels; also other arc and flame resistant applications.

Fiberglas Base

FORMICA (The Formica Insulation Company)

Available in sheet, rad, and tube.

GENERAL PROPERTIES — GRADE F-55 FIBREGLAS

Specific gravity	1.95
Grams per cu. in.	31.9

MECHANICAL PROPERTIES

Tensile strength (psi)	25,000

MECHANICAL PROPERTIES — GRADE F-55 FIBREGLAS

Compressive strength (psi) face	55,000
side	20,000
Flexural strength (psi) face	30,000
side	40,000
Impact strength (ft. lbs. per notch in.) face, side	12

ELECTRICAL PROPERTIES

Dielectric strength (volts per mil, parallel to lam., short time)	8,000
Arc resistance (seconds)	185

We Are Completely Equipped to Supply All

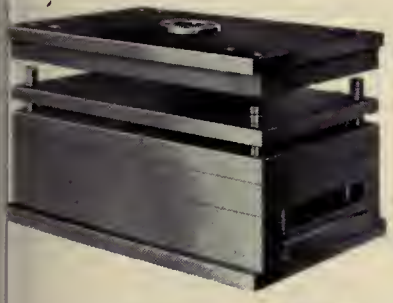
DEPENDABLE DME MOLDING EQUIPMENT

DME NEWS will be mailed you monthly upon your request. Write for it—it's interesting, informative, valuable.

Standardization has ever been the watchword at DME, and every step taken has been toward standardization in the building of mold bases and molding equipment . . . making the mold-maker's job easier, simpler and time-saving. First, with the introduction of standard mold bases; then standard mold base parts, pre-fabricated mold bases, followed by stripper plate mold bases—and NOW, with our latest product, standard sized ejector pins. You can depend upon DME to present other standardized molding equipment products when, in our opinion, they are thoroughly proven "engineeringly right."

STANDARD MOLD BASES

5 basic sizes—16 combinations of each size—offering the widest variety of standard applications. Come to you complete, ready for inserting of cavities, ejector pins, etc. Stocked for immediate delivery.



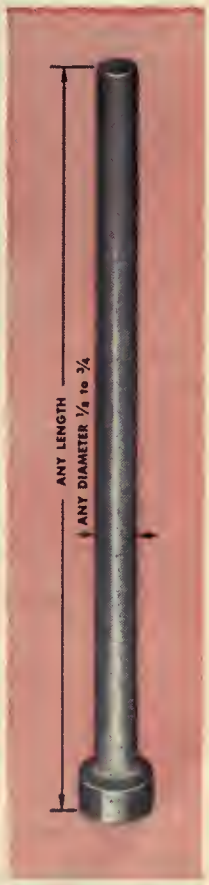
STRIPPER PLATE MOLD BASES

Four new series of standard stripper plate mold bases ranging in size from 9" x 12" to 12" x 23½"—each in five and six-plate series. A size and type for every standard requirement.

New! Standard Sized EJECTOR PINS

of Nitralloy Steel

—scientificolly heat treated, ground, polished and nitrided. Welded-on heods of soft steel. Uniformly hord—true to size—unbreakable—interchongeoble—in ony length ond in 17 stondard diameters. Immediate delivery from stock.



STANDARD SERIES PRE-FABRICATED MOLD PARTS

—ovoilable in 4 standard sizes. Eosily assembled pre-fabricated parts. No holes are drilled, enabling the mold-maker to place return pins, screws, dowels and other details to suit his particular application.

DME Standard Mold Parts for injection and compression molds—return plates, pillars, spacer blocks, pins, sprue bushings, etc.—all ovailable for immediate delivery.

DME

DETROIT MOLD ENGINEERING COMPANY
6686 EAST McNICHOLS ROAD • DETROIT 12, MICHIGAN

PHENOLITE (National Vulcanized Fibre Co.)

Available in sheet, rod and tube.

GENERAL PROPERTIES	GRADE MGB-811
Specific gravity	1.90
Water absorption (1/8" thick) (% after immersion 24 hrs.)	1.5
MECHANICAL PROPERTIES	
Tensile strength (psi)	33,000
Compressive strength (psi)	72,000
Flexural strength (psi)	49,000
Impact strength (ft. lbs. per in. notch) (Izod)	10
Modulus of elasticity (psi)	2,800,000

ELECTRICAL PROPERTIES	GRADE MGB-811
Dielectric strength (volts per mil) short time	485
Power factor (10^6 cycles)	0.016
Dielectric constant (10^6 cycles)	7.7
Dielectric loss factor (10^6 cycles)	.13
Arc resistance, by ASTM (D495-42) Test method (sec)	125

FABRICATING DATA

Can be drilled, milled, turned and punched.

THERMAL PROPERTIES	
Continuous maximum operating temperature (°F)	325

Cotton Base

FORMICA (The Formica Insulation Company)

Available in sheet, rod, and tube.

GENERAL PROPERTIES	GRADE L-41
Specific gravity	1.5
MECHANICAL PROPERTIES	
Tensile strength (psi) lengthwise	20,400
crosswise	9,200
Compressive strength (psi) flatwise	44,200
Flexural strength (psi) lengthwise	26,000
Impact strength (ft. lb. per notch in.) (Izod) lengthwise	1.2
Modulus of elasticity (psi × 10^5) lengthwise	19.2
Shear strength (psi)	12,700

FABRICATING DATA

Machining qualities: Excellent

EFFECT OF CHEMICALS

Insoluble in organic solvents; resistant to mild alkalis.

ELECTRICAL PROPERTIES	GRADE L-41
Volume resistivity (ohms cms × 10^{10})	6.8
Dielectric strength (volts per mil) short time	370
step by step	320
Dielectric constant (10^3 cycles)	8.3
after 24 hr. immersion	8.8
Dielectric constant (10^6 cycles)	7.4
after 24 hr. immersion	8.0
Power factor (10^3 cycles)	0.07
after 24 hr. immersion	0.09
Power factor (10^6 cycles)	0.044
after 24 hr. immersion	0.047
Arc resistance (sec)	175

STABILITY	GRADE L-41
Water absorption (% after immersion 24 hr.) 1 × 3 × 1/8"	1.3
Effect of age	None
Effect of sunlight	None

Nylon Base

*DILECTO MEC—2** (Continental-Diamond Fibre Co.)

OUTSTANDING QUALITIES: Arc resistance, low water absorption, high mechanical strength.
TYPICAL USES: Electrical insulation in radar and electronic equipment, especially high voltage protective covers.

Available in sheet, rod and tube.

GENERAL PROPERTIES	
Specific gravity	1.20
Cu. in. per lb.	23.0
MECHANICAL PROPERTIES	
Tensile strength (psi)	14,000
Compressive strength (psi)	40,000
Flexural strength (psi)	27,000
Impact strength (ft. lb. per notch in.) (Izod)**	8.5
Rockwell hardness	M110

ELECTRICAL PROPERTIES	
Dielectric strength (volts per mil) short time	450
stepwise	250
Dielectric constant (10^6 cycles)	3.90
Power factor (10^6 cycles)	0.070
Loss factor (10^6 cycles)	0.273
Arc resistance	70

STABILITY

Water absorption (% after immersion 24 hrs.): 0.2

* Developed jointly by Continental-Diamond Fibre Co., Newark, Del.; and Mecoboard Inc., Chicago.
** This value is for Navy condition E/48/50, Flat, MD. All tests were conducted on 1/8" material except impact, for which 1/2" was used.

PHENOL FORMALDEHYDES

Asbestos Cloth Base

TYPE: Thermosetting.
OUTSTANDING QUALITIES: Toughness, flame and heat resistance, moisture resistance.
TYPICAL USES: Low voltage parts.

PHENOL FIBRE (Taylor Fibre Company)

Available in sheet and tube. (1" min. I. D.)

MECHANICAL PROPERTIES	GRADE AA
Tensile strength (psi)	10,000
Compressive strength (psi)	38,000
Flexural strength (psi)	20,000

OPTICAL PROPERTIES	GRADE AA
Color range	Natural

ELECTRICAL PROPERTIES	1/8" thick
Dielectric strength (volts per mil) short time	50
stepwise	30

STABILITY

Water absorption (% after immersion 24 hrs.)	
1/16" thick	1.5
1/8" thick	0.85

NEW PROBLEMS?

C-D has acquired the KNOW-HOW to help you apply

INDUSTRIAL MOLDED PLASTICS

C-D technicians will help you successfully apply industrial molded plastics to your specific design and production problems. Available to you is the KNOW-HOW acquired in helping solve thousands of "What Material?" problems, by the successful application of C-D CELORON . . . a molded fabric plastic.

The unit illustrated herewith is a two piece CELORON molded macerated fabric insulating casing used in U. S. Navy equipment. Mechanical strength,dimensional stability, and thermal insulating properties, as well as electrical insulating properties were needed to meet the requirements of the service in which it is used.

Solving such problems is the every day job of C-D technicians. You will save time and worry . . . and avoid product failure . . . by consulting with C-D technicians when your products are in the blue print stage.

Wire, phone, or write the nearest C-D office . . . and a C-D technician will get on the job.

C-D PRODUCTS

The Plastics

DILECTO—Thermosetting Laminates.
CELORON—A Molded Phenolic.
DILECTENE—A Pure Resin Plastic Especially Suited to U-H-F Insulation.
HAVEG—Plastic Chemical Equipment, Pipe, Valves and Fittings.

The NON-Metallics

DIAMOND Vulcanized FIBRE
VULCOID—Resin Impregnated Vulcanized Fibre.
MICABOND—Built-Up Mica Electrical Insulation.

Standard and Special Forms

Available in Standard Sheets, Rods and Tubes; and Parts Fabricated, Formed or Molded to Specifications.

Descriptive Literature

Bulletin GF gives Comprehensive Data on all C-D Products. Individual Catalogs are also Available.

Continental Diamond C-D Engineered Laminated Plastics

—46

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SEE OUR CATALOG IN SWEET'S

Continental-Diamond FIBRE COMPANY

Established 1895..Manufacturers of Laminated Plastics since 1911—NEWARK 33 • DELAWARE

OUTSTANDING QUALITIES: Moisture resistances, insulating power, toughness.
TYPICAL USES: Aircraft instrument panels and electrical system insulation; distributor breakers, rotary pump parts.

FORMICA (The Formica Insulation Company)

Available in sheet, rod and tube.

GENERAL PROPERTIES

Specific gravity	1.36

MECHANICAL PROPERTIES

Tensile strength (psi)	8,500
Compressive strength (psi)	37,000
Flexural strength (psi)	19,000
Impact strength (ft. lbs. per notch in.) (Izod) flatwise	1.8
edgewise	1.0

FABRICATING DATA

Machining qualities	Excellent

EFFECT OF CHEMICALS

Insoluble in organic solvents; resistant to mild acids and water.

ELECTRICAL PROPERTIES

Dielectric strength (volts per mil) short time	500
stepwise	300
Dielectric constant (10^6 cycles)	5.0
Power factor (10^6 cycles)	0.045
Dielectric loss factor (10^6 cycles)	0.22

OPTICAL PROPERTIES

Color range	Natural and Black

THERMAL PROPERTIES

Top operating temperature (°F)	265

STABILITY

Water absorption (% after immersion 24 hrs.)	1.2

LAMICOID (Mica Insulator Company)

Available in sheet, rod, tube.

MECHANICAL PROPERTIES	SHEET	ROLLED TUBE
Tensile strength (psi)	8,500	5,000
Compressive strength (psi)	37,000	11,000
Flexural strength (psi)	19,000	.....

ELECTRICAL PROPERTIES	SHEET	ROLLED TUBE
Dielectric strength (volts per mil)	360	150
Dielectric constant (10^6 cycles)	5.0	...
Power factor (10^6 cycles)	0.045	...
Loss factor (10^6 cycles)	0.22	...

STABILITY

Water absorption (% after immersion 24 hrs.)	1.2

4 5

PHENOL FIBRE (Taylor Fibre Company)

Available in sheet, rod, tube, fabricated parts.

MECHANICAL PROPERTIES

Tensile strength (psi)	8,500
Compressive strength (psi)	37,000
Flexural strength (psi)	19,000

ELECTRICAL PROPERTIES

Dielectric strength (volts per mil) short time	500
(1/16" thick) stepwise	300
Dielectric constant (10^6 cycles)	5.0
Dielectric loss factor (10^6 cycles)	0.22
Power factor (10^6 cycles)	0.045

STABILITY

Water absorption (% after immersion 24 hrs.) 1/8" thick	0.90

OPTICAL PROPERTIES

Color range	Black, Natural

FABRICATING DATA

Machining qualities	Good

EFFECT OF CHEMICALS

Insoluble in most solvents; slightly affected by moderate concentrations of hydrochloric and sulfuric acids; resistant to almost all organic acids and oils.

PHENOLITE (National Vulcanized Fibre Co.)

Available in sheet, rod, tube, fabricated parts.

MECHANICAL PROPERTIES	GRADE LE MOLDED TUBE	GRADE LE SHEET
Tensile strength (psi)	7,500	9,000
Compressive strength (psi)	22,000	37,000
Flexural strength (psi)	.....	19,000
Impact strength (ft. lbs. per notch in.) (Izod)	.....	1.5

ELECTRICAL PROPERTIES		
Dielectric strength (volts per mil)	250	500
Dielectric constant (10^3 cycles)	5.0	5.0
Power factor (10^3 cycles)	0.045	0.045

THERMAL PROPERTIES

Top operating temperature (°F)	250

STABILITY

Water absorption (% after immersion 24 hrs.)	0.95 1.2

FABRICATING DATA

Machining qualities	Excellent	Excellent

OPTICAL PROPERTIES

Color range	Natural, Black	Natural, Black

SYNTHANE (Synthane Corporation)

Available in sheet, rod, tube.

MECHANICAL PROPERTIES

Tensile strength (psi)	8,500
Compressive strength (psi)	37,000
Flexural strength (psi)	19,000
Impact strength	1.8

ELECTRICAL PROPERTIES

Dielectric strength (volts per mil) short time	500
stepwise	300
Dielectric constant (10^6 cycles)	5.0
Power factor (10^6 cycles)	0.045
Dielectric loss factor (10^6 cycles)	0.22

OPTICAL PROPERTIES

Color range	Black, Natural

STABILITY

Water absorption (% after immersion 24 hrs.)	1.2

FABRICATING DATA

Machining qualities	Excellent

EFFECT OF CHEMICALS

Decomposed by chlorine, alkalis, bromine, 10% phenol, 10% hydrochloric acid, nitric acid, 15% sulfuric acid; slightly discolored but otherwise not affected by common metallic salts up to 180°F.

TUFFTOLITE (General Electric Company, Plastics Div.)

Available in sheet, rod, tube.

MECHANICAL PROPERTIES	GRADE 1841
Tensile strength (psi)	10,000
Compressive strength (psi)	30,000
Flexural strength (psi)	20,000
ELECTRICAL PROPERTIES	
Dielectric strength (volts per mil)	500
OPTICAL PROPERTIES	
Light transmission (%)	Opaque
Color range	Black, Natural
STABILITY	
Water absorption (% after immersion 24 hrs.)	0.7
FABRICATING DATA	
Machining qualities	Machines Freely

Grade C—Cotton Cloth Base (Coarse Weave)

OUTSTANDING QUALITIES: Machinability, mechanical strength.

TYPICAL USES: Mechanical applications; gears; split fairleads far aircraft; bearing staves far ships; terminal blocks.

PANELYTE (Panelyte Div., St. Regis Paper Co.)

Available in sheet, rad, tube and molding pawder.
Grade 900 available in sheet anly.

GENERAL PROPERTIES	GRADE 900C
Specific gravity	1.35
MECHANICAL PROPERTIES	
Tensile strength (psi) flat, with grain	12,200
Campressive strength (psi) flat	30,000
Flexural strength (psi) flat, with grain	20,300
Impact strength (ft. lb. per natch in.) (Izad) flat, with grain	4.5
Rockwell hardness	M90
OPTICAL PROPERTIES	
Calar range	Black, Natural
THERMAL PROPERTIES	
Expansian (°F × 10^{-5})	1.5
STABILITY	
Water absarptian (% after immersian 24 hrs.)	1.5
FABRICATING DATA	
Machining qualities	Good

PHENOL FIBRE (Taylor Fibre Company)

Available in sheet, rod, tube, fabricated parts.

MECHANICAL PROPERTIES	
Tensile strength (psi)	9,500
Campressive strength (psi)	38,000
Flexural strength (psi)	20,000
ELECTRICAL PROPERTIES	
Dielectric strength (valts per mil) shart time (1/16" thick)	200
stepwise	120
Dielectric canstant (10^6 cycles)	7.0
Dielectric lass factar (10^6 cycles)	0.70
Pawer factar (10^6 cycles)	0.10
STABILITY	
Water absarptian (% after immersian 24 hrs.) 1/16 in. thick	3.0
1/8 in. thick	1.7
OPTICAL PROPERTIES	
Calar range	Black, Natural
FABRICATING DATA	
Machining qualities	Gaad
EFFECT OF CHEMICALS	
Insaluble in mast salvents; slightly affected by maderate cancentratians af hydrochlaric and sulfuric acids; resistant ta almast all arganic acids and ails.	

VICARTA (Westinghouse Electric Corporation)

Available in plates, angles, rads, etc.

GENERAL PROPERTIES	GRADE 262
Specific gravity	1.38
MECHANICAL PROPERTIES	
Tensile strength (psi)	11,000
Campressive strength (psi)	40,000
Flexural strength (psi)	20,000
Impact strength (ft. lbs. per in. width) (Izad)	
flatwise	4.4—7.9
edgewise	2.5—4.8
Madulus of elasticity (psi × 10^6)	1
Shear strength	11,000
Rockwell hardness	M102
ELECTRICAL PROPERTIES	GRADE 262
Dielectric strength (volts per mil) shart time	150
stepwise	125
Dielectric canstant (10^6 cycles)	5.8
Power factar (10^6 cycles)	6.6
OPTICAL PROPERTIES	
Refractive index	Opaque
Color range	Tan
THERMAL PROPERTIES	
Tap aperating temperature (°F)	212
STABILITY	
Water absarptian (% after immersian 24 hrs.) 1/16 in. thick	4.5
1/2 in. thick	1.2
FABRICATING DATA	
Machining quality	Good

Grade CE Cloth Base (Coarse Weave)

PHENOL FIBRE (Taylor Fibre Company)

OUTSTANDING QUALITIES: Good electrical properties, toughness, moisture resistance.

INDICATED USES: Electrical applications requiring toughness; mechanical applications requiring greater maisture resistance than Grade C affords.

MECHANICAL PROPERTIES	
Tensile strength (psi)	8,000
Campressive strength (psi)	36,000
Flexural strength (psi)	17,000
OPTICAL PROPERTIES	
Calar range	Black, Natural

STABILITY	1/16" thk.	1/8" thk.
Water absarptian (% after immersian 24 hrs.)	1.5	1.2

ELECTRICAL PROPERTIES	1/16" thk.	1/8" thk.
Dielectric strength (valts per mil) shart time	500	360
stepwise	300	220
Dielectric canstant (10^6 cycles)	5.5	
Pawer factar (10^6 cycles)	0.055	
Dielectric lass factar (10^6 cycles)	0.30	
FABRICATING DATA		
Machining qualities	Good	

INSUROK (The Richardson Company)

OUTSTANDING QUALITIES: Dimensional stability, high mechanical and dielectric strength; punching intricate parts.

TYPICAL USES: Fine pitched gears; parts with holes close to edge.

Available in sheet, rod and tube.

GENERAL PROPERTIES	GRADE T-689
Specific gravity	1.33
Grams per cu. in.	21.7
MECHANICAL PROPERTIES	
Tensile strength (psi)	15,550
Compressive strength (psi)	40,100
Flexural strength (psi lengthwise)	21,200
Impact strength (Chorpy unnotched 4 in. centers) (overage, all directions)	6.1
Rockwell hardness	115

ELECTRICAL PROPERTIES	GRADE T-689
Dielectric strength (volts per mil) short time	560
stepwise	355
Dielectric constant	4.85
Power factor	0.04
Loss factor	0.195
STABILITY	
Tendency to cold flow (120°F, 24 hrs., 4,000 psi %)	0.35
Water absorption (%) 1/16" thick	1.75
(%) 1/8" thick	

MICARTA "444" (Westinghouse Electric Corporation)

OUTSTANDING QUALITIES: Capacity for post-forming, low cost.

TYPICAL USES: Trim tab fairings, accumulator covers, flight chart cases, tail wheel housings, machine gun ammunition feeds.

GENERAL PROPERTIES	
Specific gravity	1.37
MECHANICAL PROPERTIES	
Tensile strength (psi)	11,000—13,000
Compressive strength (psi) flatwise	41,000
Flexural strength (psi)	23,000—26,000
Impact strength (Izod) flatwise	4.6—5.5
edgewise	1.9—2.2
Modulus of elasticity (psi × 10^6)	0.9
FABRICATING AND MOLDING DATA	
Molding quality	Good
Molding methods	Hot Forming
Machining qualities	Good

ELECTRICAL PROPERTIES	
Dielectric strength (volts per mil) short time	240
stepwise	130
OPTICAL PROPERTIES	
Refractive index	Opaque
Color range	Tan, Dark Green
THERMAL PROPERTIES	
Thermal expansion (per °C × 10^{-6})	31
Thermal activity (sec/°C/sq cm/cm × 10^{-4})	6.1
Specific heat (cal. per °C per gram)	0.4
STABILITY	
Water absorption (% after immersion 24 hrs.) (1/16 × 1 × 3)	2.8

Note: Values are for tan product, maximums and minimums being values with and across grain.

TEXTOLITE (General Electric Company, Plastics Div.)

OUTSTANDING QUALITIES: Lubricating property, strength.

TYPICAL USES: Intricate-shaped bearings requiring good strength.

Available in sheet, rod, tube.

GENERAL PROPERTIES	GRADE 2,001 SHEETS
Specific gravity	1.39
Odor	None
Taste	None
MECHANICAL PROPERTIES	
Tensile strength (psi)	13,000 L, 8,500 C
Compressive strength (psi)	35,000
Flexural strength (psi)	24,000 L, 17,000 C
Impact strength (ft. lbs. per notch in.) (Izod)	2.5
Rockwell hardness	M103
ELECTRICAL PROPERTIES	
Dielectric strength (volts per mil)	68
Dielectric constant (10^6 cycles)	8.27
Power factor (10^6 cycles)	0.046

OPTICAL PROPERTIES	GRADE 2,001 SHEETS
Refractive index, N/D	Opaque
THERMAL PROPERTIES	
Thermal expansion (per °C)	1.35 × 10^{-5} L, 2.14 × 10^{-5} C
Top operating temperature (°F)	230
Softening point (°F)	None
Distortion under heat (°F)	Greater than 300
Burning rate	Slow
STABILITY	
Tendency to cold flow	Low
Water absorption (% after immersion 48 hrs.)	1.0
Effect of age	None
EFFECT OF CHEMICALS	
Unaffected by water, oils, solvents, and most acids; attacked by strong acids and alkalies.	

Fiberglas Base

FORMICA (The Formica Insulation Company)

OUTSTANDING QUALITIES: Dielectric strength, resistance to heat.

TYPICAL USES: Motor slot wedges.

Available in sheet, rod and tube.

GENERAL PROPERTIES	GRADE FF-10
Specific gravity	1.67
MECHANICAL PROPERTIES	
Tensile strength (psi)	14,800
Flexural strength (psi)	22,000
Impact strength (ft. lbs. per notch in.) (Izod) Flatwise	8.5
Edgewise	4.4

ELECTRICAL PROPERTIES	GRADE FF-10
Dielectric strength (volts per mil) short time	300
stepwise	200
Dielectric constant (10^6 cycles)	5
Power factor (10^6 cycles)	.028
Loss factor (10^6 cycles)	0.14
STABILITY	
Water absorption (% after immersion 24 hrs.) (1 × 3 × 1/8")	2.2
EFFECT OF CHEMICALS	
Resistant to organic solvents.	

ALIN (Damascus Furniture Corporation)

OUTSTANDING QUALITIES: High strength-weight ratio, flexural strength.

TYPICAL USES: Aircraft structural parts.

CHANICAL PROPERTIES

Tensile strength (psi)	40,000
Compression strength (psi)	35,000
Flexurol strength (psi)	60,000
Rockwell hordness	M50—M60

Nylon Base

LECTO MEC—1* (Continental-Diamond Fibre Co.)

OUTSTANDING QUALITIES: Excellent electrical insulating properties; mechanical strength; excellent resistance to fungi.
TYPICAL USES: Electrical insulating parts in radar and other high fidelity communications equipment.

Avoilable in sheet, rod and tube.

ENERAL PROPERTIES

Specific gravity	1.15
Cu. in. per lb	24

ECHANICAL PROPERTIES

Tensile strength (psi) lengthwise	9,500
crosswise	8,400
Compressive strength (psi) flatwise	31,000
Flexural strength (psi) flat, lengthwise	22,000
flat, crosswise	21,000
Impact strength (ft. lb. per notch in.) (Izod) ASTM	
Navy condition E/48/50, flat, MD	6.5
CD	6.0
edge MD	3.5
CD	3.0
Rockwell hardness	M110

ERMAL PROPERTIES

Deformation under load (%) (ASTM) 1/32"	4.60
1/16"	5.10
1/8"	1.50

ELECTRICAL PROPERTIES

Volume resistivity (megohms cm^3)	
Navy condition E/96/50	3,000,000
D/96/50	650,000
Dielectric strength (volts per mil) perpendicular	
Navy condition A, short time	475
stepwise	375
Dielectric constant (10^6 cycles)	
Navy condition E/96/50	3.48
D/48/50	3.57
Power factor (10^6 cycles)	
Navy condition E/96/50	0.030
D/48/50	0.037
Loss factor (10^6 cycles)	
Navy condition E/96/50	0.109
D/48/50	0.132
Arc resistance, ASTM (sec)	
Navy condition A	12—30
Insulation resistance (megohms)	
Navy condition E/96/50	150,000
D/96/50	125,000
ASTM	30,000

STABILITY

Water absorption (% after immersion 24 hrs.) (ASTM)	0.20

* Developed jointly by Continental-Diamond Fibre Co., Newark, Del., and Mecoboord Inc., Chicago.
Note: All tests were conducted on 1/8" material except impact, for which 1/2" was used.

Grade XXP—Paper Base

OUTSTANDING QUALITIES: High dielectric, mechanical strength; suitability for hot punching; high strength-weight ratio.
TYPICAL USES: Insulation for radio and electronic equipment.

ORMICA (The Formica Insulation Company)

Availoble in sheet.

ENERAL PROPERTIES — GRADE XX

Specific gravity	1.36

ECHANICAL PROPERTIES

Tensile strength (psi)	8,000
Compressive strength (psi)	34,000
Flexural strength (psi)	16,000
Impact strength (ft. lbs. per notch in.) (Izod) edgewise	.40

ELECTRICAL PROPERTIES — GRADE XX

Dielectric strength (volts per mil) short time	700
stepwise	500
Dielectric constant (10^6 cycles)	5.0
Power factor (10^6 cycles)	.040
Dielectric loss factor (10^6 cycles)	.20

STABILITY

Water absorption (% after immersion 24 hrs.)	1.3

FABRICATING DATA

Machining qualities	Good

EFFECT OF CHEMICALS

Insoluble in organic solvents, resistant to mild acids and salt solutions.

AMITEX (Franklin Fibre-Lamitex Corp.)

ECHANICAL PROPERTIES

Tensile strength (psi)	8,000
Flexurol strength (psi)	15,000

LECTRICAL PROPERTIES

Dielectric strength (volts per mil) short time	700
stepwise	500
Dielectric constant (10^6 cycles)	4.2
Power factor (10^6 cycles)	3.0
Loss factor (10^6 cycles)	12.0

STABILITY

Water absorption (% after immersion 24 hrs.)	1.0

FABRICATING DATA

Machining qualities	Good

PHENOL FIBRE (Taylor Fibre Company)

Available in sheet, rod, tube.

MECHANICAL PROPERTIES

Tensile strength (psi)	8,000
Compressive strength (psi)	25,000
Flexural strength (psi)	16,000

ELECTRICAL PROPERTIES

Dielectric strength (volts per mil) short time	700
(1/16" thick) stepwise	500
Dielectric constant (10^6 cycles)	5.0
Power factor (10^6 cycles)	0.040
Dielectric loss factar (10^6 cycles)	0.20

OPTICAL PROPERTIES

Refractive index	Opaqu
Color range	Black, Brown, Nature

STABILITY

Water absorption (% after immersion 24 hrs.) 1/16 in. thick	1.
1/8 in. thick	0.9

FABRICATING DATA

Machining qualities	Goo
Punches hot	

EFFECT OF CHEMICALS

Insaluble in mast salvents; slightly affected by maderate cancentratio of sulfuric and hydrochloric acids; resistant to almast all arganic acid and oils.

SPAULDITE (Spaulding Fibre Company)

Available in sheet.

MECHANICAL PROPERTIES

Tensile strength (psi)	10,000
Compressive strength (psi) Flatwise	31,000
Flexural strength (psi)	18,000
Impact strength (ft. lbs. per natch in.) (Izod) Edgewise, Lengthwise	0.45
Crasswise	0.40

ELECTRICAL PROPERTIES

Dielectric constant (10^6 cycles)	5.0
Power factor (10^6 cycles)	0.04
Loss factor (10^6 cycles)	0.2

OPTICAL PROPERTIES

Color range	Black, Natural, Walnut Brow

SYNTHANE (Synthane Corporation)

Available in sheet, rad, tube.

MECHANICAL PROPERTIES

Tensile strength (psi)	8,000
Compressive strength (psi)	25,000
Flexural strength (psi)	16,000

ELECTRICAL PROPERTIES

Dielectric strength (valts per mil) shart time	700
stepwise	500
Dielectric constant (10^6 cycles)	5.0
Pawer factor (10^6 cycles)	0.040
Dielectric lass factor (10^6 cycles)	0.20

STABILITY

Water absarptian (% after immersian 24 hrs.)	1.3

Other Paper Base Grades

CONSOWELD (Consolidated Water Power & Paper Co., Plastics Div.)

OUTSTANDING QUALITIES: High strength, suitability for low pressure molding.

TYPICAL USES: Panels, molded shapes, composite construction.

Available in mat, panel.

GENERAL PROPERTIES — GRADE CPS MP11 G1

Specific gravity	1.38
Grams per cu. in.	22.6

MECHANICAL PROPERTIES

Tensile strength (psi)	26,000
Compressive strength (psi)	20,000
Flexural strength (psi)	25,000
Impact strength (ft. lbs. per natch in.) (Izod) flatwise	4.00
edgewise	0.65
Modulus af elasticity (psi × 10^6)	2.2
Elongatian (%)	1.6
Rockwell hardness	M100
Brinell hardness	34
Shear strength (psi) flatwise	14,000
edgewise	18,000

OPTICAL PROPERTIES — GRADE CPS MP11 G1

Color range	Natural, Black, Olive Drab

THERMAL PROPERTIES — GRADE CPS MP11 G1

Top operating temperature (°F) (Continuous)	250
Thermal expansion (10^{-5} per °C)	2.0

STABILITY — GRADE CPS MP11 G1

Water absorptian (%, unsealed edges) (% after immersion 24 hrs.)	2.0—3.5
Effect of age	None
Effect af sunlight	Same Color Shades Affected

EFFECT OF CHEMICALS — GRADE CPS MP11 G1

Resistant to organic solvents, weak acids, gasaline, ail; none ta slight effect in strang reducing and organic acids and weak alkalies; slight ta marked effect in strang oxidizing acids; slight swelling to delaminating in strong alkalies.

PANELYTE (Panelyte Div., St. Regis Paper Co.)

OUTSTANDING QUALITIES: High strength-weight ratio, suitability for molding and structural applications.

TYPICAL USES: Large refrigerator, aircraft and automotive parts.

Available in sheet only.

GENERAL PROPERTIES — GRADE 270

Grams per cu. in	22
Odar (for refrigerator applications)	None

MECHANICAL PROPERTIES

Tensile strength (psi)	16,200
Compressive strength (psi) flat, with grain	45,000
Flexural strength (psi) flat, with grain	26,900
Impact strength (ft. lbs. per in.) flat, with grain	2.20
edge, with grain	0.90
Shear strength (psi) flat, with grain	14,700
Rockwell hardness	M111

OPTICAL PROPERTIES — GRADE 270

Color range	Black

THERMAL PROPERTIES

Thermal expansian (per °F × 10^{-5}) with grain	90
across grain	1.8
Top operating temperature (°F)	300

STABILITY

Water absarptian (% after immersian 24 hrs.)	1.50

FABRICATING DATA

Machining qualities	Good

ECTO (Continental-Diamond Fibre Company)

OUTSTANDING QUALITIES: Low power loss, stable electrical properties under severe conditions.

TYPICAL USES: Insulating parts of radio circuits.

Available in sheet.

CHANICAL PROPERTIES	GRADE XPLW
ensile strength (psi)	10,000
Compressive strength (psi)	30,000
Flexural strength (psi)	20,000

ELECTRICAL PROPERTIES	GRADE XPLW
Dielectric strength (volts per mil)	600
Dielectric constant (10^6 cycles)	4.00
Power factor (10^6 cycles)	.026
STABILITY	
Water absorption (% after immersion 24 hrs.)	0.75

DERON* (C. W. Plywood Company)

OUTSTANDING QUALITIES: Strength, resistance to moisture, weathering and chemical action.

INDICATED USES: Lining refrigerator cars, kitchen cabinets, boxes, trunks, table tops, pre-fabricated house walls, floors, partitions, boat material, etc.

Available in roll and sheet.

NERAL PROPERTIES	WITH GRAIN	CROSS GRAIN
Specific gravity	1.39	1.39
CHANICAL PROPERTIES		
Tensile strength (psi)	18,000	14,000
Compressive strength (psi)	32,800	32,800
Flexural strength (psi)	17,200	15,200
Impact strength (ft. lbs. per notch in.) (Izad) flatwise	2.56	1.56
edgewise	0.58	0.56
Modulus of elasticity (psi × 10^5)	16	11.5
Shear strength (psi)	12,000	12,000
Rockwell hardness	M127.4	M127.4

OPTICAL PROPERTIES	WITH GRAIN	CROSS GRAIN
Color range	Olive Drab, Brown, Black	
THERMAL PROPERTIES		
Thermal conductivity (Btu/sq. ft./hr./°F/in.)	1.4—2.3	1.4—2.3
STABILITY		
Water absorption (% after immersion 24 hrs.)	.2	2.5

EFFECT OF CHEMICALS

Resistant to weak acids and inorganic weak alkalies, alcohols, hydrocarbons, mineral, vegetable and animal oils; good resistance to ketones, acetones and esters.

wood surfaced with "Kimpreg," a product of Kimberly-Clark Corporation. A similar laminate with similar properties—called "Laminex"—is produced by Wheeler-Osgood Co.

Wood Veneer Base

EGWOOD (Formica Insulation Company)

ECHANICAL PROPERTIES	GRADE 1100
Tensile strength (psi)	30,000
Compressive strength (psi)	20,000
Flexural strength (psi)	40,000
Impact strength (ft. lbs. per inch notch) (Izad) flatwise	7.0
edgewise	6.0
STABILITY	
Water absorption (% after immersion 24 hrs.) (test piece 1 × 3 × 1 3/8 in.)	2.5

te: All laminations are parallel in this type.

HENOL FURFURALS (and FORMALDEHYDES)

TYPE: Thermosetting.

OUTSTANDING QUALITIES: Excellent electrical properties; heat and solvent resistance, low cold flow, tensile strength

TYPICAL USES: Switch plates, sockets, door knobs, bottle caps, business machine housings.

URITE (Durite Plastics)

ENERAL PROPERTIES	CLOTH BASE	PAPER BASE
Specific gravity	1.3—1.36	1.3—1.36
Grams per cu. in.	21.3—20.4	21.3—20.4
ECHANICAL PROPERTIES		
Tensile strength (psi)	8,000—12,000	7,000—18,000
Compressive strength (psi)	30,000—44,000	20,000—40,000
Flexural strength (psi)	13,000—30,000	13,000—20,000
Impact strength (ft. lbs. per notch in.) (Izad)	1.4—15.0	0.6—7.6
Modulus of elasticity (psi × 10^5)	3.5—15	4—30
Rockwell hardness	M70—M120	M70—M120
LECTRICAL PROPERTIES		
Volume resistivity (ohms cms)	10^{10}—10^{12}	10^{10}—10^{13}
Dielectric strength (volts per mil):		
Short time	150—600	400—1000
Stepwise	150—400	250—600
Dielectric constant (10^6 cycles)	4.5—7	3.6—5.5
Power factor (10^6 cycles)	0.02—0.08	0.02—0.08

OPTICAL PROPERTIES	CLOTH BASE	PAPER BASE
Light transmission (%)	Opoque	Opaque
Color range	Limited	Limited
THERMAL PROPERTIES		
Thermal conductivity (10^{-4} cal. sec., cm. °C)	.5—8	5—8
Specific heat (cal. per °C per gram)	0.3—0.4	0.3—0.4
Thermal expansion (10^{-5} per °C)	1.7—3.0	1.7—2.5
Top operating temperature (°F)	212—250	212—250
Softening point (°F)	None	None
Distortion under heat (°F)	320 (Min.)	320 (Min.)
Burning rate	Very Low	Very Low
STABILITY		
Water absorption (% after immersion 24 hrs.)	0.3—9.0	0.3—9.0
Effect of sunlight	Lowers Surface Resistance	Lowers Surface Resistance
FABRICATING AND MOLDING DATA		
Molding qualities	Limited	Limited
Machining qualities	Fair to Excellent	Fair to Excellent
Effect on metal inserts	None	None

EFFECT OF CHEMICALS

Slightly affected by weak acids and alkalies; strongly affected by strong acids and alkalies; very little to slight effect in organic solvents.

ote: These values cover both Durite Phenol Furfural and Phenol Formaldehyde laminates.

Westinghouse

Some of Micarta's many industrial applications:

AVIATION INDUSTRY

Pulleys
Antenna masts
Foir-leads
Ammunitian chutes
Data cases
Valve parts
Instrument panels
Landing strut bearings
Structural angles and channels

MARINE INDUSTRY

Propeller shaft bearings
Rudder stock bearings
Pintle bushings
Switchboard panels
Pulleys in mechanical telegraph systems
Gears
Pump valves
Piston rings

CENTRAL STATION INDUSTRY

Switchboard panels
Channels
Terminal blocks
Armature wedges
Terminal strips
Bus supports
Pull rods
Waterwheel bearings

RADIO INDUSTRY

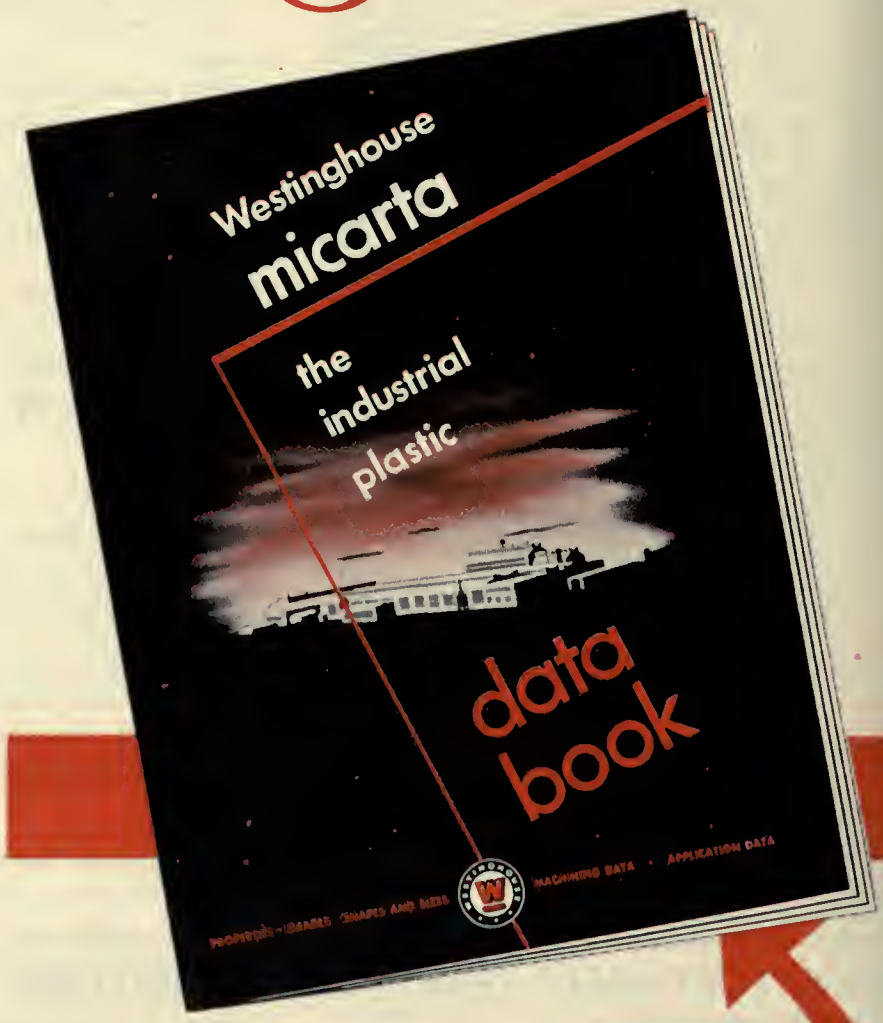
Coil forms
Panels
Tube sockets
Meter and fuse mountings
Supports
Terminal boards
Switch plates
Terminal blocks

STEEL INDUSTRY

Roll neck bearings
Run-out tables
Pickle lines
Hold-down rolls
Up coiler rolls
Punch rolls
Carrying rolls
Insulators

MANUFACTURING INDUSTRY

In-a-door refrigerator panels
Automobile timing gears
Breaker strips



PAPER INDUSTRY

Suction box covers
Doctor blades
Toe blocks
Bearings
Shakesprings
Table roll covers

TEXTILE INDUSTRY

Gears
Rayon spinning buckets
Bobbins
Pirns
Bearings and pulleys

PROCESS INDUSTRIES

Plating barrels
Valve blocks
Tubing

Write for new Micarta Data Book

For complete information, write for new Micarta Data Book B-3184-B. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania.

YOUR NO. 1 SOURCE OF LAMINATED INDUSTRIAL PLASTICS

The list of applications on the opposite page are but a few examples of the many industrial uses now served by Westinghouse Micarta.

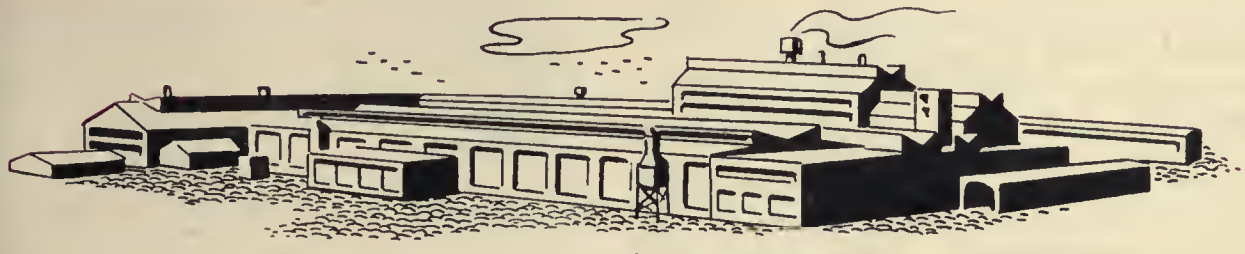
They represent the result of more than a third of a century of successful development and production on a scope unequaled by any other producer of laminated plastics. Micarta's outstanding properties are the reason. Micarta is unaffected by water—whether it be boiling hot or ice cold. In fact, used as a bearing material, water is its best lubricant. Micarta's high compressive strength is outstanding in jobs requiring a hard working material, yet it is lighter than aluminum—can be machined, sawed, tapped, drilled, punched and threaded to precise dimensions with common machine tools.

Micarta is one of the best known insulating materials—has high dielectric strength and resists corrosion and mild acids.

In addition to producing standard forms, Micarta's vast manufacturing facilities are available for turning out completely fabricated parts inexpensively, on a production basis to meet your specifications and delivery requirements.

Progressive manufacturers with a critical eye on profits are invited to call in a Micarta Specialist when working out design on manufacturing plans. Westinghouse Electric Corporation, P O. Box 868, Pittsburgh 30, Pa.

J-06393



Westinghouse Electric Corporation
East Pittsburgh, Penna.

MOLDED PLASTICS

(Includes sheet, rod, tube, film)

ACRYLICS (METHYL METHACRYLATES)

TYPE: Thermoplastic.

OUTSTANDING QUALITIES: Excellent transparency, light transmission, weather resistance, chemical resistance, low specific gravity and water absorption, dielectric strength, dimensional stability, electrical properties.

TYPICAL USES: Costume jewelry, medical instruments, lenses, demonstration models, shatter-resistant windows, parts for chemical apparatus, insulators, compass parts and cases, dials and meter faces, indicators and parts. Sheets: visual training aids, safety shields, picture frames, furniture, displays, machine guards, transparent aircraft enclosures. Molded: dairy equipment parts, combs, signal equipment, reflectors, cigarette cases, hairbrushes, batteries.

LUCITE (duPont Plastics Dept.)

Available in sheet, rod, tube and molding powder.

GENERAL PROPERTIES	MOLDED	SHEET
Specific gravity	1.17—1.18	1.18
Grams per cu. in.	19.5	19.5
Odor	None	None
Taste	None	None
MECHANICAL PROPERTIES		
Tensile strength (psi)	8,700—10,400	7,500
Compressive strength (psi)	16,000	11,000
Flexural strength (psi)	14,700—19,600	13,500
Impact strength (ft. lbs. per notch in.) (Izad)	0.40—0.44	0.47
Modulus of elasticity (psi × 10^5)	4	3—5
Elongation (%)	2.3—3	1
Shear strength (psi)	8,200—8,500	9,000
Rockwell hardness	M102—M112	M98
Stiffness (psi)	356,000—386,000	370,000
ELECTRICAL PROPERTIES		
Volume resistivity (ohms cms)	Over 10^{15}	Over 10^{15}
Dielectric strength (volts per mil) short time	390—400	400
Dielectric constant (60 cycles)	3.4—3.5	4.5
Dielectric constant (10^3 cycles)	3.3	3.2
Dielectric constant (10^6 cycles)	2.8—2.9	2.7
Power factor (60 cycles)	0.047—0.055	0.05
Power factor (10^3 cycles)	0.040—0.043	0.044
Power factor (10^6 cycles)	0.018—0.021	0.015

OPTICAL PROPERTIES	MOLDED	SHEET
Refractive index, N/D	1.493—1.502	1.496
Light transmission (%)	91—91.5	92
Color range	Unlimited	Unlimited
THERMAL PROPERTIES		
Haze (%)	2	1
Thermal conductivity (/Btu/hr./ft.²/°F/in.)	1.6—2.3	2
Specific heat (cal. per °C per gram)	0.35	0.35
Thermal expansion (per °F × 10^{-5})	3.9—4.9	4.9
Tap operating temperature (°F)	125—140	140
Distortion under heat (°F) 66 psi	173—216	172
Burning rate (in. per min.)	1.4—1.5	1.1
Flow temperature (°C)	147—165	
Deformation under load (%) 4,000 psi, 122°F	2—12	23
STABILITY		
Water absorption (%)	0.28—0.3	0.3
Effect of age	Very Slight	Very Slight
Effect of sunlight	Very Slight	Very Slight
FABRICATING AND MOLDING DATA		
Molding qualities	Excellent	Excellent
Molding methods	Compression, Injection, Extrusion	Forming
Machining qualities		Excellent

EFFECT OF CHEMICALS

Unaffected by weak acids, weak alkalis; attacked by strong acids, strong alkalis; soluble in lower ketones, esters.

PLEXIGLAS (Rohm & Haas Company)

Available in sheet and molding powder.

GENERAL PROPERTIES	MOLDED	SHEET
Specific gravity	1.18—1.19	1.18
Grams per cu. in.	19.5	19.5
Odor	None	None
Taste	None	None
MECHANICAL PROPERTIES		
Tensile strength (psi)	7,000—9,000	5,800—8,800
Compressive strength (psi)	12,000—15,000	13,000—15,000
Flexural strength (psi)	12,000—15,000	13,000—15,000
Impact strength (ft. lbs. per in.), unnotched bar (Charpy)	3—4	3—4
Modulus of elasticity (psi × 10^5)	4—5	3—4
Elongation (%)	1—5	min. 2
Rockwell hardness	M70	M70
ELECTRICAL PROPERTIES		
Volume resistivity (ohms cm^3)	Over 10^{15}	Over 10^{15}
Dielectric strength (volts per mil) short time	500	short time...500
stepwise	400	stepwise....400
Dielectric constant (60 cycles)	3.5—4.0	3.4—3.6
Dielectric constant (10^3 cycles)	3.2—3.4	3.2—3.4
Dielectric constant (10^6 cycles)	2.7—3.3	2.5
Power factor (60 cycles)	5—6	5—6
Power factor (10^3 cycles)	3—4	5—6
Power factor (10^6 cycles)	2—3	2.5
STABILITY		
Tendency to cold flow	Slight	Very Slight
Water absorption (% after immersion 24 hrs.)	0.6	0.6
Effect of age	Very Slight	Very Slight
Effect of sunlight	Very Slight	Very Slight

OPTICAL PROPERTIES		
Refractive index, N/D	1.488—1.489	1.488—1.489
Light transmission (%)	90—92	90—92
Haze (%)	2—4	1—3
Density	0.036	0.036
	MOLDED	SHEET
Color range	Red, amber, yellow, green, aquamarine, blue, violet, white, opaque, brown opaque, black opaque, pastel tints.	Red, ruby, amber, yellow, green, dark green, blue, white translucent, tints.
THERMAL PROPERTIES		
Thermal conductivity (10^{-4} cal. sec., sq. cm. °G cm.)	4—6	4—6
Specific heat (cal. per °C per gram)	0.35	0.35
Thermal expansion (per °C × 10^{-5})	8—9	8
Top operating temperature (°F)	130—185	130—185
Distortion under heat (°F)	160—180	140
Burning rate	Very Slow	Very Slow
FABRICATING AND MOLDING DATA		
Molding qualities	Excellent	Excellent
Molding methods	Extrusion, Injection, Compression	Forming, Also can be blown
Machining qualities	Excellent	Excellent
Effect on metal inserts	Excellent	.....

EFFECT OF CHEMICALS

Unaffected by weak acids, weak alkalis; attacked by strong acids, strong alkalis; soluble in lower ketones, esters, alcohols, carbon tetrachloride.

ANILINE FORMALDEHYDES

TYPE: Thermasetting.
OUTSTANDING QUALITIES: Tensile and dielectric strength.
TYPICAL USES: Bushings, insulation, binder.

IBANITE (Ciba Products Corporation)

Available in molding powder.

GENERAL PROPERTIES

Specific gravity	1.22—1.25

MECHANICAL PROPERTIES

Tensile strength (psi)	8,500—10,000
Compressive strength (psi)	20,000—23,000
Flexural strength (psi)	12,000—20,000
Impact strength (ft. lbs. per notch in.) (Izod)	0.32
Modulus of elasticity (psi × 10^5)	5—6
Rockwell hardness	M115—M120

ELECTRICAL PROPERTIES

Volume resistivity (ohms cms)	10^{15}—10^{16}
Dielectric strength (volts per mil) short time	600—650
stepwise	400—600
Dielectric constant (60 cycles)	3.7—3.8
Dielectric constant (10^3 cycles)	3.7
Dielectric constant (10^6 cycles)	3.5—3.6
Power factor (10^6 cycles)	0.006—0.008

OPTICAL PROPERTIES

Color range	Dark colors only

THERMAL PROPERTIES

Thermal conductivity (10^{-4} cal. sec., cm. °C)	2.6
Specific heat (cal. per °C per gram)	0.4
Thermal expansion (per °C × 10^{-5})	5—6
Softening point (°F)	260
Distortion under heat (°F)	210—245

STABILITY

Water absorption (% after immersion 24 hrs.)	0.01—0.08
Effect of age	None
Effect of sunlight	Darkens

FABRICATING AND MOLDING DATA

Molding qualities	Fair
Molding methods	Compression
Machining qualities	Good to Excellent

EFFECT OF CHEMICALS

Insoluble in many organic solvents and oils; decomposed by strong acids; slightly affected by weak acids and strong alkalis.

CASEINS

TYPE: Thermaplastic.
OUTSTANDING QUALITIES: Non-flammability, colorability, machinability.
TYPICAL USES: Buttons, poker chips, novelties, pens.

MEROID (American Plastics Corp.)

Available in sheet, rod, tube, discs.

GENERAL PROPERTIES

Specific gravity	1.35

MECHANICAL PROPERTIES

Tensile strength (psi)	10,000
Compressive strength (psi)	27,000—53,000
Flexural strength (psi)	10,000—18,000
Impact strength (ft. lbs. per notch in.) (Izod)	1.0
Elongation (%)	2.5
Brinell hardness	23

THERMAL PROPERTIES

Thermal expansion (10^{-5} per °C)	4.1—6.8
Softening point (°F)	200
Distortion under heat (°F)	300
Burning rate	Very Slow

ELECTRICAL PROPERTIES

Dielectric strength (volts per mil)	400—700
Dielectric constant (10^6 cycles)	6.1—6.8
Power factor (10^6 cycles)	.052

OPTICAL PROPERTIES

Color range	Wide

STABILITY

Water absorption (% after immersion 24 hrs.)	.7—1.4

FABRICATING AND MOLDING DATA

Molding qualities	Poor
Molding methods	Injection, Extrusion
Machining qualities	Excellent

EFFECT OF CHEMICALS

Resistant to weak acids and organic solvents; softens when exposed to weak alkalis; decomposes in strong acids or strong alkalis.

Note. Values for Galorn, made by George Marrell Corp., are similar to those above.

CELLULOSE ACETATES

TYPE: Thermaplastic.
OUTSTANDING QUALITIES: Toughness, transparency, colorability, ease of molding, uniform texture and quality, high luster, dielectric strength. High acetyl types: Resistance to moisture and hot water.
TYPICAL USES: Housings, telephones, tool handles, toys, containers, lenses, lamp shades, packaging, grilles, automobile and radio parts, electrical insulation, control knobs, buttons, combs, pencil ferrules, sun goggles, handbags, models, goggles. High acetyl type uses: Precision instruments, steering wheels and other automotive parts, refrigerator parts, novelties, kitchen utensils, costume jewelry.

LUMARITH X (Celanese Plastics Corporation)

Available in molding compound.

GENERAL PROPERTIES

Specific gravity	1.27—1.32

MECHANICAL PROPERTIES

Tensile strength (psi)	3,200—6,500
Flexural strength (psi)	3,400—12,400
Impact strength (ft. lbs. per notch in.) (Izod)	1.3—5.1
Elongation (%)	12—50
Brinell hardness	5—12

ELECTRICAL PROPERTIES

Dielectric strength (volts per mil)	290—365

OPTICAL PROPERTIES

Color range	Limitless

STABILITY

Water absorption (% after immersion 24 hrs.)	2.1—2.8

FABRICATING AND MOLDING DATA

Molding qualities	Extremely fast
Molding methods	Extrusion, Compression, Injection
Machining qualities	Excellent

EFFECT OF CHEMICALS

Unaffected by water, weak sulfuric, nitric, hydrochloric acids; 10% sodium chloride, gasoline, 2% sodium carbonate; swells in carbon tetrachloride, 50% ethyl alcohol.

CHEMACO (Chemaco Corp.)

Available in molding powder.

GENERAL PROPERTIES

Specific gravity	1.27—1.37
Odor	None
Taste	None

MECHANICAL PROPERTIES

Tensile strength (psi)	8,500—10,000
Compressive strength (psi)	5,000—30,000
Flexural strength (psi)	1,500—12,000
Impact strength (ft. lbs. per notch in.) (Izod)	0.7—6.0
Modulus of elasticity (psi × 10^5)	0.6—3.5
Elongation (%)	4—45
Rockwell hardness	M20—M80

EFFECT OF CHEMICALS

Decomposes in strong acids and alkalies; resistant to weak acids and alkalies.

ELECTRICAL PROPERTIES

Volume resistivity (ohms cms)	10^{10}—10^{12}
Dielectric strength (volts per mil) short time	290—365
Dielectric constant (60 cycles)	3.5—6.4
Dielectric constant (10^3 cycles)	3.5—6.4
Dielectric constant (10^6 cycles)	3.2—6.2
Power factor (60 cycles)	0.01—0.06
Power factor (10^6 cycles)	0.01—0.06

OPTICAL PROPERTIES

Refractive index, N/D	1.47
Light transmission (%)	88—92
Color range	Unlimited

FABRICATING AND MOLDING DATA

Molding qualities	Excellent
Molding methods	Injection, Compression, Extrusion, Blowing
Machining qualities	Excellent
Effect on metal inserts	Inert

CHEMACO W (Chemaco Corp.)

Available in molding powder.

GENERAL PROPERTIES

Specific gravity	1.30
Grams per cu. in.	21.3
Odor	None
Taste	None

MECHANICAL PROPERTIES

Tensile strength (psi)	7,100—10,300
Impact strength (ft. lbs. per notch in.) (Charpy)	2.1—4.0
Elongation (%)	8.8—18.0
Brinell hardness	6.5—9.0

OPTICAL PROPERTIES

Color range	Unlimited

THERMAL PROPERTIES

Softening point (°F)	163—196

STABILITY

Water absorption (% after immersion 96 hrs.) (Note: Other tables give this value for 24 hr. immersion.)	1.00—1.9

FABRICATING AND MOLDING DATA

Molding qualities	Excellent
Molding methods	Injection, Compression, Extrusion
Machining qualities	Good to Excellent

EFFECT OF CHEMICALS

Unaffected by water, weak sulfuric, nitric, hydrochloric acids; 10% sodium chloride, gasoline, 2% sodium carbonate. Swells in carbon tetrachloride, 50% ethyl alcohol.

FIBESTOS (Monsanto Chemical Co., Plastics Div.)

Available in sheet, rod, tube and molding powder.

	MOLDED	SHEET
GENERAL PROPERTIES		
Specific gravity	1.29—1.33	1.29—1.40
MECHANICAL PROPERTIES		
Tensile strength (psi)	1,700—8,300	4,000—10,000
Compressive strength (psi)	5,000—21,000	6,000—30,000
Flexural strength	3,300—14,000	4,000—20,000
Impact strength (ft. lbs. per notch in.) (Izod)	0.3—4.6	1.0—4.0
Modulus of elasticity (psi × 10^5)	1.3—2.5	1—3
Elongation (%)	10—70	15—80
Rockwell hardness	Up to M95	75—M60
FABRICATING AND MOLDING DATA		
Molding qualities	Excellent	Excellent
Molding methods	Injection	Injection
	Extrusion	Compression
	Compression	Extrusion
		Swaging, Forming
Machining qualities	Good to Excellent	Good to Excellent
Effect on metal inserts	None	Non-corrosive

EFFECT OF CHEMICALS

Unaffected by cold water, aromatic and aliphatic hydrocarbons; swells in hot water; fair resistance to weak acids and alkalis; decomposes in strong acids and alkalis; soluble in lower ketones, dioxane.

	MOLDED	SHEET
ELECTRICAL PROPERTIES		
Volume resistivity (ohms cms)	10^{10}—10^{12}	(5—25) × 10^{-}
Dielectric strength (volts per mil)	290—600	290—80
Dielectric constant (60 cycles)	3.5—6.4	
Dielectric constant (10^3 cycles)	3.5—6.4	5—7
Dielectric constant (10^6 cycles)	3.2—6.2	4—6
Power factor (60 cycles)	0.01—0.06	
Power factor (10^3 cycles)	0.01—0.06	
Power factor (10^6 cycles)	0.01—0.05	
OPTICAL PROPERTIES		
Refractive index, N/D	1.47—1.50	1.49—1.52
Light transmission (%)	88—92	88—92
Color range	Unlimited	Unlimited
THERMAL PROPERTIES		
Thermal conductivity (10^4 cal. sec., cm. °C × 10^{-4})	4—6	4—6
Specific heat (cal. per °C per gram)	0.3—0.45	0.3—0.45
Thermal expansion (per °C × 10^5)	6—15	6—15
Top operating temperature (°F)	100—180	130—160
Softening point (°F)	140—230	140—230
Distortion under heat (°F)	110—190	110—190
Burning rate	Slow	1.5—2.0 in. per m.
STABILITY		
Water absorption (% after immersion 24 hrs.)	2.2—6.7	2—4.0
Effect of age	Good Resistance	Hardens

LUMARITH C. A. (Celanese Plastics Corp.)

Available in molding compound, sheet, rod, tube, film, foil.

	MOLDED	SHEET
GENERAL PROPERTIES		
Specific gravity	1.30—1.34	1.28—1.34
Grams per cu. in.	21.3—22	
MECHANICAL PROPERTIES		
Tensile strength (psi)	3,600—6,900	3,500—8,000
Impact strength (ft. lbs. per notch in.) (Izod)	2.0—5.5	1.5—5.5
Elongation (%)	20—50	20—65
Brinell hardness	5—8	5—10
ELECTRICAL PROPERTIES		
Dielectric strength (volts per mil)	290—365	1,300—1,600
STABILITY		
Water absorption (% after immersion 24 hrs.)	2.6—4.5	2.5—7.0
FABRICATING AND MOLDING DATA		
Molding qualities	Excellent	
Molding methods	Compression, Extrusion, Injection	Blowing, Compression, Heat Forming, Swedging
Machining qualities	Good to Excellent	Good to Excellent

EFFECT OF CHEMICALS

Unaffected by water, weak sulfuric, nitric, hydrochloric, acids; 10% sodium chloride, gasoline, 2% sodium carbonate. Swells in carbon tetrachloride, 50% ethyl alcohol.

NION C. A. (Nixon Nitration Works)

Available in sheet and molding powder.

GENERAL PROPERTIES

Specific gravity	1.28—1.37

MECHANICAL PROPERTIES

Tensile strength (psi)	5,200—8,100
Compressive strength (psi)	20,000—30,000
Flexural strength (psi)	8,500—14,000
Impact strength (ft. lb. per notch in.) (Izod)	1.0—2.5
Modulus af elasticity (psi × 10^5)	1.8—2.4
Elongatian (%)	15—38
Rockwell hardness	R110—R121

ELECTRICAL PROPERTIES

Volume resistivity (ohms cms)	10^{10}—10^{12}
Dielectric strength (volts per mil)	250
Dielectric constant (60 cycles)	3.5—7.5
Dielectric constant (10^3 cycles)	3.5—7.0
Dielectric constant (10^6 cycles)	3.2—7.0
Power factor (60 cycles)	0.01—0.06
Power factor (10^3 cycles)	0.01—0.06
Power factar (10^6 cycles)	0.01—0.20

OPTICAL PROPERTIES

Refractive index N/D	1.46—1.50

[Molded Cellulose Acetates] Cont.

Light transmission (%)	90
Color range	Unlimited

THERMAL PROPERTIES

Conductivity (10^{-4} cal. sec. cm. °C)	4—8
Specific heat (cal. /°C/gram)	0.30—0.45
Expansion (°C)	(8—16) × 10^{-5}
Top operating temperature (°F)	150
Distortian under heat (°F)	140—183
Burning rate	Slow

STABILITY

Tendency to cald flow	Good
Water absorption (% after immersion 24 hrs.)	2.5
Effect of age	Good
Effect of sunlight	Good

FABRICATING AND MOLDING DATA

Molding qualities	Good
Molding methods	Injection, Compression, Extrusion, Transfer
Machining qualities	Good
Effect on metal inserts	None

EFFECT OF CHEMICALS

Insaluble in carbon tetrachloride, toluene; soluble in alcahals, ketones; resistant to 3% hydrogen peroxide, 3% sulfuric acid, 5% acetic acids.

FASTACELE (duPont Plastics Dept.)

Available in sheet, molding powder.

GENERAL PROPERTIES	MOLDED	SHEET
Specific gravity	1.27—1.37	1.27—1.37
MECHANICAL PROPERTIES		
Tensile strength (psi)	1,500—10,000	2,800—8,000
Flexural strength (psi)	2,000—15,000	6,000—9,000
Impact strength (ft. lbs. per notch in.) (Izad)	0.5—7.0	1.4—4.0
Modulus of elasticity (psi × 10^5)	1—4	
Elangation (%)	8—60	25—50
Shear strength (psi)		5,000—9,000
Rockwell hardness	R20—R130	R105—R115
Stiffness (psi)		185,000—253,000
OPTICAL PROPERTIES		
Refractive index, N/D	1.47—1.50	1.49—1.50
Calor range	Unlimited	Unlimited
ABILITY		
Water absorption (% after immersion 24 hrs.)	1.6—6	2—6
Effect of age	Slight	
Effect of sunlight	Slight Discoloration	Slight Discaloration

ELECTRICAL PROPERTIES	MOLDED	SHEET
Volume resistivity (ohms cms)	10^{10}—10^{12}	4 × 10^{12}—50 × 10^{12}
Dielectric strength (volts per mil)	250—365	275—350
Dielectric constant (60 cycles)	3.5—7.5	5—6.5
Dielectric constant (10^6 cycles)	3.2—7	5—6
Power factor (60 cycles)	0.01—0.06	0.02—0.03
Power factor (10^3 cycles)		0.02—0.04
Power factor (10^6 cycles)	0.01—0.10	0.03—0.06
THERMAL PROPERTIES		
Thermal conductivity (Btu/hr/ft²/°F/in)	5.4—8.7	
Specific heat (cal. per °C per gram)	0.3—0.45	0.30—0.45
Thermal expansion (per °F × 10^{-5})	5—10	4—10
Distortion under heat (°F) 66 psi		165—190
Burning rate	Slow	Very Slow
Flaw temperature (°C)	235—350	
Defarmation under load (%) 4,000 psi, 122°F	1—75	15—30
FABRICATING AND MOLDING DATA		
Molding methods	Compression, Injection, Extrusion	Forming
Machining qualities	Good	Good

EFFECT OF CHEMICALS

Slightly affected by weak acids and weak alkalis; decomposed by strang alkalis; soluble in acetone; acetates, lactates and essential oils.

TENITE I (Tennessee Eastman Corporation)

Available in molding pellets and granules.

GENERAL PROPERTIES

Specific gravity (20°C/20°C)	1.27—1.34
Odor	Negligible
Taste	Negligible

MECHANICAL PROPERTIES

Tensile strength (psi)	1,500—7,500
Compressive strength (psi)	4,500—22,500
Flexural strength (psi)	2,100—14,000
Impact strength (ft. lbs./inch of notch) (Izod)	0.4—6.2
Modulus of elasticity (psi × 10^5)	0.74—2.62
Elongation (%)	7—74
Rockwell hardness	R38—R123

OPTICAL PROPERTIES

Refractive index, N/D^{25}	1.50—1.46
Light transmission (%)	75—95
Color range	Unlimited

FABRICATING AND MOLDING DATA

Molding qualities	Excellent
Molding methods	Injection; Extrusion; Blowing; Compression
Machining qualities	Good
Effect on metal inserts	None

ELECTRICAL PROPERTIES

Volume resistivity (ohms cms.) 50% RH	10^{10}—10^{12}
Dielectric strength, 60 cycles, 50% RH	290—600
Dielectric constant (60 cycles) 50% RH	3.5—6.4
Dielectric constant (10^6 cycles)	3.2—6.2
Power Factor (60 cycles) 50% RH	0.01—0.06
Power factar (10^6 cycles) 50% RH	0.01—0.05

THERMAL PROPERTIES

Thermal conductivity (cal./sq. cm./sec./°C/cm. × 10^{-4})	4—8
Specific heat (cal./°C/gm.)	0.3—0.45
Thermal expansion (inch/inch/°C × 10^{-5})	8—16
Top operating temperature (°F)	500
Softening point (°F)	140—250
Distortion under heat (°F) (264 psi)	112—216
Burning rate	Slow
Flow temperature (°F)	248—347

STABILITY

Tendency to cold flow	Slight
Water absorption (after immersion 24 hrs.): Total %	2.5—5.9; soluble matter last %, less than 0.1—3.3
Effect of age	Some Loss in Weight
Effect of Sunlight	Warpage and surface crazing after long exposure

EFFECT OF CHEMICALS

Unaffected by water, weak acids, salt solutions, hydrocarbons, and ethers; swollen by alcohols; dissolved by some esters, ketones, chlorinated hydrocarbons.

CELLULOSE ACETATE BUTYRATE

TYPE: Thermaplastic.

OUTSTANDING QUALITIES: Toughness, calarability, surface luster, ease af molding, dimensional stability, high impac strength, and in some compasitians resistance to weathering.

TYPICAL USES: Steering wheels, telephones, toothbrush and taal handles, divider strips, pistol grips, (extruded) trim safety lamps (at sea), hausings, musical instruments, drafting scales, automobile and radia parts, insulation, irrigatio tubes, shawer nazzles.

TENITE II (Tennessee Eastman Corporation)

Available in malding pellets and granules.

GENERAL PROPERTIES

Specific gravity (20°C/20°C)	1.10—1.24
Odor	Negligible
Taste	Negligible

MECHANICAL PROPERTIES

Tensile strength (psi)	1,400—6,600
Campressive strength (psi)	4,200—19,800
Flexural strength (psi)	1,600—11,900
Impact strength (ft. lbs./inch of notch) (Izod)	0.4—9.4
Modulus af elasticity (psi × 10^5)	0.49—1.98
Elongation (%)	35—94
Rockwell hardness	R38—R119

OPTICAL PROPERTIES

Refractive index, N/D^{25}	1.47—1.48
Light transmission (%)	75—95
Color range	Unlimited

STABILITY

Tendency ta cold flaw	Slight
Water absarptian (after immersian 24 hrs.) (%)—Total, 1.0—2.4; soluble matter last, less than	0.1—1.1
Effect of age	Slight
Effect of sunlight	Some compasitians satisfactory

ELECTRICAL PROPERTIES

Volume resistivity (ohms cms.) 50% RH	10^{10}—10^{1}
Dielectric strength, 60 cycles, 50% RH (volts/mil)	250—40
Dielectric canstant (60 cycles) 50% RH	3.5—6.
Dielectric canstant (10^6 cycles) 50% RH	3.2—6.
Pawer factar (60 cycles) 50% RH	0.01—0.0
Pawer factor (10^6 cycles) 50% RH	0.01—0.0

THERMAL PROPERTIES

Thermal canductivity (cal./sq. cm./sec./°C/cm. × 10^{-4})	4—
Specific heat (cal./°C/gm.)	0.3—0.
Thermal expansian (in./in. °C × 10^{-5})	11—17
Tap operating temperature (°F)	50
Softening point (°F)	140—25
Distartian under heat (°F)	103—19
Burning rate	Slow
Flow temperature (°F)	251—34

FABRICATING AND MOLDING DATA

Malding qualities	Excellent
Molding methods	Injection; Extrusion; Blowing; Compressior
Machining qualities	Good
Effect an metal inserts	None

EFFECT OF CHEMICALS

Unaffected by water, weak ocids, salt solutians, aliphatic hydrocarbons, and ethers; swollen by alcohols and aramatic hydracarbons, dissalved by same esters, ketanes and chlarinated hydrocarbons.

CELLULOSE NITRATES

*Note: Cellulose nitrates are not moldable in the usual sense; are included in this group only for convenience.

TYPE: Thermosplastic.

OUTSTANDING QUALITIES: Taughness, dimensianal stability, calarability and brilliance, ease af fabricatian.

TYPICAL USES: Tool and umbrella handles, tailet ware and seats, fauntain pen and pencil sets, novelties, drawing instruments, buttons, photograph halders, shoe heel coverings, spectacle frames, piano keys.

CELLULOID (Celanese Plastics Corporation)

Available in sheet, rad, tube, and film.

GENERAL PROPERTIES

Specific gravity	1.35—1.40

MECHANICAL PROPERTIES

Tensile strength (psi)	4,000—11,000
Elangatian (%)	10—50

ELECTRICAL PROPERTIES

Dielectric strength (volts per mil)	300—500

STABILITY

Water absorption (% after immersion 24 hrs.)	1.5—3.0

FABRICATING AND MOLDING DATA

Farming methods	Heat Farming, Compressian, Blowing
Machining qualities	Excellent

EFFECT OF CHEMICALS

Saluble in lower alcohols; attacked by strang alkalies and strong oxidizing acids; resistant ta water, dilute alkolies and acids and, when cold, strang non-oxidizing acids.

NITRON (Monsanto Chemical Co., Plastics Div.)

Available in sheet, rad, tube.

GENERAL PROPERTIES

Specific gravity	1.35—1.60

MECHANICAL PROPERTIES

Tensile strength (psi)	5,000—10,000
Compressive strength (psi)	20,000—30,000
Flexural strength (psi)	6,000—15,000
Impact strength (ft. lbs. per notch in.) (Izod)	2.0—8.0
Madulus of elasticity (psi × 10^5)	2—4
Elongation (%)	10—50
Shear strength (psi)	3,000—8,000
Rockwell hardness	M26—M60

ELECTRICAL PROPERTIES

Volume resistivity (ohms cms)	(2—30) × 10^{10}
Dielectric strength (volts per mil) short time	600—1200
stepwise	250—500
Dielectric constant (60 cycles)	6.7—7.3
Dielectric constant (10^6 cycles)	6.2
Pawer factar	0.06—0.15
Pawer factor (10^6 cycles)	0.07—0.10

OPTICAL PROPERTIES

Refractive index, N/D	1.48—1.58
Light transmission (%)	86—90
Calar range	Unlimited

THERMAL PROPERTIES

Thermal conductivity (cal. sec., cm. °C × 10^{-4})	3.1—5.1
Thermal expansion (per °C × 10^{-5})	12.0—16.0
Top operating temperature (°F)	140
Softening point (°F)	160—195
Distortion under heat (°F)	110—150
Burning rate	Very Rapid

STABILITY

Tendency ta cald flow	Slight ta Marked
Water absorption (% after immersian 24 hrs.)	0.6—3.0

FABRICATING AND MOLDING DATA

Machining qualities	Excellent

EFFECT OF CHEMICALS

Soluble in lower alcohals and ketones; attacked by strong alkalies and strang oxidizing acids; resistant to water, dilute alkalies and acids and, when cold, strong non-oxidizing acids.

1896* 1946

*December 1, 1896, Cruver Mfg. Co. received its first shipment of cellulose nitrate sheet stock for fabrication

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NEW YORK DETROIT

NIXON C. N. (Nixon Nitration Works)

Available in sheet, rod and tube.

GENERAL PROPERTIES

Specific gravity	1.35—1.72
Odor	Camphor

MECHANICAL PROPERTIES

Tensile strength (psi)	3,000—10,000
Compressive strength (psi)	20,000—30,000
Flexural strength (psi)	6,000—15,000
Impact strength (ft. lb. per notch in.) (Izod)	3—8
Modulus of elasticity (psi × 10^5)	1.5—3.0
Elongation (%)	25—50
Shear strength (psi)	4,000—9,000
Rockwell hordness	R90—R120

ELECTRICAL PROPERTIES

Volume resistivity (ohms cms)	(2—30) × 10^{10}
Dielectric strength (volts per mil)	300—500
Dielectric constant (60 cycles)	6.7—7.3
Power factor (60 cycles)	0.06—0.15

EFFECT OF CHEMICALS

Soluble in ketanes, esters, lower alcohols; resistant to woter, hydrocarbans, dilute alkalies, dilute acids.

OPTICAL PROPERTIES

Refractive index N/D	1.48—1.58
Light transmission (%)	0.90
Color ronge	Unlimited

THERMAL PROPERTIES

Conductivity (10^4 col. sec./cm./°C)	3.1—5.1
Specific heat (col./°C/gram)	0.34—0.38
Expansion (°C)	(9—16) × 10^{-5}
Top operating temperature (°F)	120
Distortion under heat (°F)	110—150
Burning rote	Rapid

STABILITY

Tendency ta cald flow	Good
Water absorption (% after immersian 24 hrs.)	Less than 1
Effect of age	Good
Effect of sunlight	Poor

FABRICATING AND MOLDING DATA

Farming methods	Compression
Machining qualities	Excellent
Effect on metal inserts	Good

PYRALIN (duPont Plastics Dept.)

Avoiloble in sheet, rod, tube.

GENERAL PROPERTIES

Specific gravity	1.33—1.60

MECHANICAL PROPERTIES

Tensile strength (psi)	3,000—8,000
Compressive strength (psi)	20,000—30,000
Impact strength (ft. lbs. per natch in.) (Izod)	5—9
Shear strength (psi)	5,000—8,000
Flexural strength (psi)	6,000—15,000
Modulus of elosticity (psi × 10^5)	2—4
Elongatian (%)	25—50
Rockwell hordness	R90—R120
Stiffness (psi)	200,000

OPTICAL PROPERTIES

Refroctive index, N/D	1.48—1.55
Color ronge	Unlimited

EFFECT OF CHEMICALS

Unaffected by weak acids but decomposed by strong acids; gradually decomposed by alkalis; soluble in olcohols, esters.

ELECTRICAL PROPERTIES

Volume resistivity (ohms cms × 10^{11})	1—
Dielectric strength (volts per mil)	250—500
Dielectric constant (60 cycles)	6.7—7.3
Dielectric constant (10^6 cycles)	6.0—6.2
Pawer factor (60 cycles)	0.03—0.12
Power factar (10^6 cycles)	0.06—0.10

THERMAL PROPERTIES

Thermal conductivity (Btu/hr/ft²/°F/in.)	1.4—1.8
Thermal expansion (per °F × 10^{-5})	7—16
Distortion under heat (°F) 66 psi	170—185
Burning rate	Rapid
Specific heat (cal/gm/°C)	0.34—0.38
Deformation under load (%) 4,000 psi, 122°F	3

STABILITY

Water absorption (% ofter Immersion 24 hrs.)	0.5—4.0
Effect of sunlight	Discolors ond Becames Brittle

FABRICATING AND MOLDING DATA

Molding methods	Non
Machining qualities	Excellen

CELLULOSE PROPIONATE

TYPE: Thermoplastic.

OUTSTANDING QUALITIES: Excellent surface lustre and colorability, superior flow quality, excellent electrical properties toughness, high impact strength, low moisture absorption, good dimensional stability.

TYPICAL USES: Airplane steering wheels, radio housings, spectacle frames, flashlights.

FORTICEL (Celanese Plastics Corporation)

Available in molding compound.

GENERAL PROPERTIES

Specific gravity	1.17—1.22
Odor	None

MECHANICAL PROPERTIES

Tensile strength (psi)	2,800—6,000
Flexurol strength (psi)	4,800—10,000
Impact strength (ft. lbs. per notch in.) (Izod)	0.8—11.4
Elongotion (%)	25—43
Rockwell hardness	R63—R104

ELECTRICAL PROPERTIES

Power foctor (10^6 cycles)	0.019—0.032
Dielectric constant (10^6 cycles)	3.3—3.5

THERMAL PROPERTIES

Heot distortion (°F)	120—15
Flow (°C)	150—17
Weight loss on heoting	0.3—2.

STABILITY

Woter absorption (% ofter immersion 24 hrs.)	1—1.
Soluble motter lost (% ofter Immersion 24 hrs.)	None to 0.

OPTICAL PROPERTIES

Color ronge	Unlimite

MOLDING DATA

Molding quolities	Extremely fa
Molding methods	Extrusion, Injectio

ETHYL CELLULOSES

TYPE: Thermoplastic.

OUTSTANDING QUALITIES: Toughness, even at low temperatures; good electrical properties; low moisture absorption; dimensional stability in dry heat and humidity.

TYPICAL USES: Flashlight, vacuum cleaner, and radio housings; tool handles; aircraft and refrigerator parts; coil cores; trim; rigid containers; precision instruments; steering wheels; fabric and metal coatings.

ETHOCEL E. C. (Chemaco Corp.)

Available in molding powder.

GENERAL PROPERTIES

Specific gravity	1.07—1.18
Odor	Slight
Taste	None

MECHANICAL PROPERTIES

Tensile strength (psi)	2,000—10,000+
Compressive strength (psi)	8,000—20,000
Flexural strength (psi)	3,000—12,000
Impact strength (ft. lbs. per notch in. (Izod)	0.6—11.5
Modulus of elasticity (psi × 10^5)	1—5.0
Elongation (%)	5—100
Rockwell hardness	M25—M90

EFFECT OF CHEMICALS

Soluble in organic solvents; resistant to weak acids, all alkalies.

ELECTRICAL PROPERTIES

Volume resistivity (ohms cms)	10^{13}—10^{14}
Dielectric strength (volts per mil)	400—700
Dielectric constant (60 cycles)	2.5—3.5
Dielectric constant (10^6 cycles)	2.0—4.0
Power factor (60 cycles)	0.005—0.015
Power factor (10^6 cycles)	0.007—0.040

OPTICAL PROPERTIES

Refractive index, N/D	1.470
Light transmission (%)	Variable
Color range	Unlimited

FABRICATING AND MOLDING DATA

Molding qualities	Excellent
Molding methods applicable	Injection, Compression, Extrusion
Machining qualities	Good
Effect on metal inserts	Inert

METHOCEL (Dow Chemical Company)

Available in sheets and molding powder.

GENERAL PROPERTIES

Specific gravity	1.09—1.14
Grams per cu. in.	18.7
Odor	Slight to None

MECHANICAL PROPERTIES

Tensile strength (psi)	3,500—6,500
Compressive strength (psi)	5,000—12,000
Flexural strength (psi)	4,000—11,000
Impact strength (ft. lbs. per notch in.) (Izod)	2.2—6.5
Modulus of elasticity (psi × 10^5)	1.5—3.0
Elongation (%)	6.5—30
Rockwell hardness	R80—R110

ELECTRICAL PROPERTIES

Volume resistivity (ohms cms)	1-10 × 10^{12}
Dielectric strength (volts per mil)	1,400—1,700
Dielectric constant (60 cycles)	3.2—3.6
Dielectric constant (10^3 cycles)	3.0—3.5
Dielectric constant (10^6 cycles)	2.8—3.2
Power factor (60 cycles)	0.005—0.015
Power factor (10^3 cycles)	0.010—0.020
Power factor (10^6 cycles)	0.020—0.035

OPTICAL PROPERTIES

Refractive index, N/D	1.47
Color range	Extensive

THERMAL PROPERTIES

Thermal conductivity (cal/cm^2/°C/cm/sec. × 10^{-4})	3.0—4.5
Specific heat (cal. per °C per gram)	0.28—0.75
Thermal expansion (10^{-5}/°C)	15
Distortion under heat (°F)	115—140
Burning rate	Slow

STABILITY

Water absorption (% after immersion 24 hrs.)	1.60—2.40
Effect of age:	
Outdoor resistance	Good
Indoor resistance	Excellent
Effect of sunlight	Resistance, Good

FABRICATING AND MOLDING DATA

Molding qualities	Excellent
Molding methods applicable	Compression, Injection, Extrusion
Machining qualities	Good
Effect on metal inserts	Inert

EFFECT OF CHEMICALS

Not affected by alkalies; reacts slightly to weak acids; decomposed by strong acids; very soluble in many organic solvents.

NIXON E. C. (Nixon Nitration Works)

Available in sheet and molding powder.

GENERAL PROPERTIES

Specific gravity	1.08—1.16

MECHANICAL PROPERTIES

Tensile strength (psi)	3,000—8,000
Compressive strength (psi)	7,000—20,000
Impact strength (ft. lb. per notch in.) (Izod)	3—10
Modulus of elasticity (psi × 10^5)	1.0—4.5
Elongation (%)	2—20
Shear strength (psi)	11,200—14,000
Rockwell hardness	R20—R110

ELECTRICAL PROPERTIES

Volume resistivity (ohms cms)	(1—10) × 10^{12}
Dielectric strength (volts per mil)	470
Dielectric constant (60 cycles)	3.2
Dielectric constant (10^3 cycles)	3.0—3.8
Dielectric constant (10^6 cycles)	3.0—3.7
Power factor (60 cycles)	0.0002—0.03
Power factor (10^3 cycles)	0.008—0.015
Power factor (10^6 cycles)	0.017—0.036

EFFECT OF CHEMICALS

Soluble in alcohols, ketones; widely soluble in organic solvents; resistant to weak and strong alkalis.

OPTICAL PROPERTIES

Refractive index N/D	1.47
Light transmission (%)	90
Color range	Unlimited

THERMAL PROPERTIES

Conductivity (10^4 cal. sec./cm./°C)	(4—6) × 10^4
Specific heat (cal./°C/gram)	0.32—0.46
Expansion (°C)	(10—14) × 10^{-5}
Top operating temperature (°F)	160
Distortion under heat (°F)	110—200
Burning rate	Slow

STABILITY

Tendency to cold flow	Good
Water absorption (% after immersion 24 hrs.)	1.2—2.1
Effect of age	Good
Effect of sunlight	Good

FABRICATING AND MOLDING DATA

Molding qualities	Good
Molding methods	Injection, Compression, Transfer
Machining qualities	Good
Effect on metal inserts	None

DOW

new drive

What makes products sell? As peacetime production swings upward, that question requires close re-examination by everybody making plastic products. Selling is again of paramount importance.

Dow believes that it is the superior properties of quality plastics like Styron that make products sell. Styron's dimensional stability and acid resistance recommend it for rugged products like batteries. Its easy moldability and low water absorption give it the call for refrigerator parts. Its brightness and clarity even make it worthy of costume jewelry and containers for fine cosmetics. And Styron proved in many tough wartime applications that it is the name you can *depend* on in plastics.

Every manufacturer hopes for materials that bring ease and speed to production, better low-cost products, increased profits and prestige. Styron is such a material.

This and other Dow plastics—Ethocel, Saran—demand new appraisal for many products of growing peacetime industries. Now that the war is over, you're on your own in a new bid for markets. A call to any Dow sales office will help insure your future with better products.

Styron's brilliant clarity, low moisture absorption and stability at low temperatures make it broadly useful in ice compartment doors and other refrigerator parts.

Styron's excellent electrical properties, resistance to acids and dimensional stability meet requirements for battery cases.

Closures are a recommended use for Styron because of its wide range of chemical resistance and low moisture absorption.

Tea strainers demonstrate the ad[a]bility of Styron to a variety of products in which it is used in combination with metals.

LASTICS

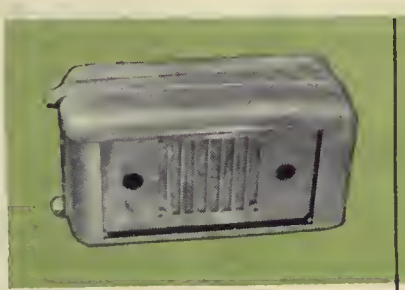
ward better products!

ETHOCEL

r durable molded products, Ethocel is the choice of nufacturers in many fields. Ethocel is exceptionally gh and dimensionally stable, under varying climatic nditions and temperatures. It is made transparent translucent and in a wide range of flow.

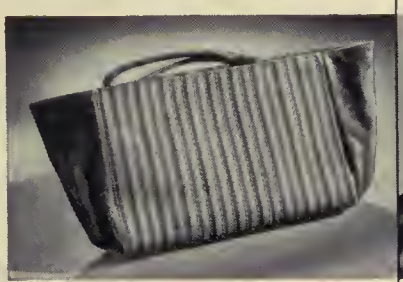
SARAN

is Dow product is a plastic-of-all-trades. Its high istance to moisture and most chemicals, corrosion d abrasion recommend it for use in many industries. is making chemically-resistant pipe and tubing; lorful, rustproof screen, and textile monofilaments fabrics that offer broad new possibilities in color d wearing qualities for shoes, draperies, luggage, holstery and transportation seating. It also makes a de variety of molded products, including chemical paratus, plumbing parts and equipment, funnels, ttles and closures. Saran Film has many applications protective packaging. New Dow developments in ran have brought Saran F-122 Latex and Saran 120 Resin, which makes possible more moisture- oof flexible coatings for paper, fabrics, wood, metal d rubber.

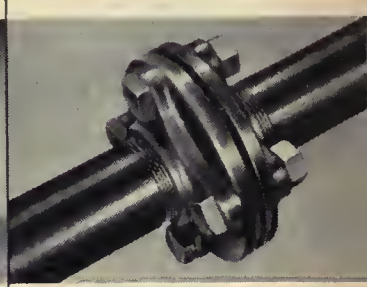


Ethocel provides tough, light, colorful cabinets for table radios.

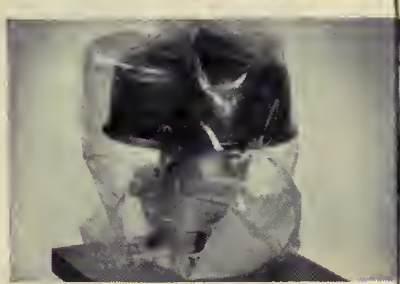
With injection molding Ethocel produces attractive toy telephones.



Handbags of Saran offer long wear, bright colors, ease of cleaning.



Saran pipe and tubing resist corrosion and most chemicals, even acids.



Moistureproof, dustproof barriers of Saran Film protect fine products.

Upholstery fabrics of Saran offer new ideas of serviceability, beauty.

Let's work it out together

in plastics is measured only in end products. It calls for the com- fforts of manufacturers, designers, fabricators, and raw material rs. Dow is ready to do its part. Save time and money—call on d get the most out of plastics.

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DOW

PLASTICS

STYRON • SARAN • SARAN FILM • ETHOCEL • ETHOCEL SHEETING

LUMARITH E. C. (Celanese Plastics Corporation)

Available in sheet and molding powder.

GENERAL PROPERTIES

Specific gravity	1.07—1.18
Grams per cu. in.	18.7

MECHANICAL PROPERTIES

Tensile strength (psi)	2,700—8,000
Impact strength (ft. lbs. per notch in.) (Izod)	.5—11
Elongation (%)	5—40
Brinell hardness	4.0—8.5

ELECTRICAL PROPERTIES

Dielectric strength (volts per mil)	470—550

STABILITY

Water absorption (% after immersion 24 hrs.)	1.2—2.5

FABRICATING AND MOLDING DATA

Molding qualities	Excellent
Molding methods applicable	Compression, Injection, Extrusion
Effect on metal inserts	Inert

EFFECT OF CHEMICALS

Not affected by alkalies; reacts slightly to weak acids; decomposed by strong acids; very soluble in many organic solvents

MELAMINE FORMALDEHYDES

TYPE: Thermosetting.

OUTSTANDING QUALITIES: Surface hardness; excellent arc resistance and good electrical properties; resistance to heat, water and chemicals; unlimited range of colors; excellent weathering characteristics.

TYPICAL USES: Insulation, tableware, buttons, housings, closures, electrical appliances and hardware, radio cabinets.

MELMAC (American Cyanamid Co.)

	GRADE 1077 ALPHA CELLULOSE	GRADE 1500 CELLULOSE	GRADE 3020 CHOPPED COTTON
Available in molding compound			
GENERAL PROPERTIES			
Specific gravity	1.49	1.40—1.45	1.4
Grams per cu. in.	24.2	22.9—23.7	22.9
Odor	None	None	None
Taste	None	None	None
MECHANICAL PROPERTIES			
Tensile strength (psi)	7,570	6,000	7,000
Compressive strength (psi)		25,000	
Flexural strength (psi)	14,000	11,000	14,000
Impact strength (ft lb per notch in.) (Izod)	0.26	0.30—0.34	0.686—1.0
ELECTRICAL PROPERTIES			
Dielectric strength (volts per mil)	340	380—450	270
Dielectric constant (60 cycles)	7.9	6.5	
Dielectric constant (10^6 cycles)	7.0		7.2
Power factor (60 cycles)	3.7	0.05	
Power factor (10^6 cycles)	2.9		4
Arc resistance		95—130	
OPTICAL PROPERTIES			
Color range	Translucent to Black	White	Blue, Black, White, Brown, Red	Mottled Mottled
Light transmission (%)			

	GRADE 1077 ALPHA CELLULOSE	GRADE 1500 CELLULOSE	GRADE 3020 CHOPPED COTTON
THERMAL PROPERTIES			
Conductivity (10^{-4} cal. sec. /cm./°C)		8.4	
Top operating temperature (°F)	210		240
Softening point (°F)	None		None
Distortion under heat (°F)	410		310
Burning rate	Non-flammable	Self-extinguishing	Non-flammable
FABRICATING AND MOLDING DATA			
Molding qualities	Excellent	Excellent	Good
Molding methods	Compression	Compression Transfer	Compression, Transfer
Machining qualities	Good	Good	Good
Effect on metal inserts		None	

EFFECT OF CHEMICALS

Not affected by weak acids and alkalies, water, organic solvents; decomposed by strong acids; heat resistant grades inert to strong alkalies.

STABILITY

Tendency to cold flow		None	
Water absorption (% after immersion 24 hrs. at 25°C)	0.6	0.34—0.40	0.6

PLASKON MELAMINE (Plaskon Division, Libbey-Owens-Ford)

Available in molding powder.

GENERAL PROPERTIES

Specific gravity	1.47—1.52
Odor	None
Taste	None

MECHANICAL PROPERTIES

Tensile strength (psi)	8,000—13,000
Compressive strength (psi)	27,000—37,000
Flexural strength (psi)	10,000—16,000
Impact strength (ft. lbs. per notch in.) (Izod)	0.24—0.35
Rockwell hardness	M118—M122

FABRICATING AND MOLDING DATA

Molding methods	Compression, Transfer
Machining qualities	Fair
Effect on metal inserts	None

ELECTRICAL PROPERTIES

Volume resistivity (ohms cms)	10^{12}—10^{18}
Dielectric strength (volts per mil) (short time)	300—400
Dielectric constant (60 cycles)	9.0—9.5
Dielectric constant (10^6 cycles)	7.8—8.2
Power factor (60 cycles)	.037—.080
Power factor (10^6 cycles)	.043—.045
Arc resistance (unconditioned test specimen)	180—186

OPTICAL PROPERTIES

Color range	Unlimited

THERMAL PROPERTIES

Resistance to heat (continuous)	210 F
Top operating temperature (°F)	210

STABILITY

Tendency to cold flow	None
Water absorption (% after immersion 24 hrs.)	0.4—0.5
Effect of age	None
Effect of sunlight	None

EFFECT OF CHEMICALS

Not affected by weak acids and alkalies, organic solvents; decomposed by strong acids.

RESIMENE (Monsanto Chemical Co., Plastics Div.)

Available in molding powder.

GENERAL PROPERTIES	GRADE 803A
Specific gravity	1.44—1.86
Odor	None
Taste	None
MECHANICAL PROPERTIES	
Tensile strength (psi)	6,000—7,500
Compressive strength (psi)	25,000—30,000
Flexural strength (psi)	8,000—16,500
Impact strength (ft. lbs. per notch in. (Izod)	0.28—1.30
Modulus of elasticity (psi $\times 10^5$)	10—16
Elongation (%)	0.30—0.45
Rockwell hardness	M112
ELECTRICAL PROPERTIES	
Volume resistivity (ohms cms)	2.3×10^{11}
Dielectric strength (volts per mil)	350—450
Dielectric constant (60 cycles)	6.4—9.9
Power factor (60 cycles)	0.07—0.17
THERMAL PROPERTIES	
Thermal expansion (per °C $\times 10^{-5}$)	2.0—4.5
Top operating temperature (°F)	210—380
Softening point (°F)	None
Distortion under heat (°F)	266—385
Burning rate	Nil
STABILITY	
Tendency to cold flow	Very Slight
Water absorption (% after immersion 24 hrs.)	0.08—1.7
Effect of age	Practically None
Effect of sunlight	None
FABRICATING AND MOLDING DATA	
Molding qualities	Excellent to Good
Molding methods	Compression; Transfer
Machining qualities	Fair to Good
Effect on metal inserts	None

EFFECT OF CHEMICALS

Not affected by weak acids and alkalies, water and organic solvents; decomposed by strong acids; heat resistant grades inert to strong alkalies.

Mineral Filler

MELMAC (American Cyanamid Co.)

OUTSTANDING QUALITIES: Heat and arc resistance, dielectric strength.
TYPICAL USES: Ignition parts, circuit breakers, terminal blocks, industrial controls.

GENERAL PROPERTIES	GRADE 592	GRADE S-6003
Specific gravity	1.7	1.98
Grams per cu. in.	26.2	30.8
MECHANICAL PROPERTIES		
Tensile strength (psi)	5,900	5,920
Flexural strength (psi)	9,280	9,180
ELECTRICAL PROPERTIES		
Dielectric strength (volts per mil)	400	440
Dielectric constant (60 cycles)	7.7	8.5
Dielectric constant (10^6 cycles)	5.65	5.8
Power factor (60 cycles)	.10	11
Power factor (10^6 cycles)	3.8	2.8

THERMAL PROPERTIES	GRADE 592	GRADE S-6003
Coefficient of expansion (per °C $\times 10^{-6}$)	43	30
Distortion under heat (°F)	266	266
FABRICATING AND MOLDING DATA		
Molding qualities	Good	Good
Molding methods	Compression Transfer	Compression Transfer
Effect on inserts	Good	Not recommended for large inserts
STABILITY		
Water absorption (% after immersion 24 hrs. ar 25° C)	0.13	0.07

NYLONS

TYPE: Thermoplastic.

NYLON (duPont Plastics Dept.) — Molded

OUTSTANDING QUALITIES: High heat distortion, toughness, flexibility, low specific gravity, solvent resistance.
TYPICAL USES: Electrical spools, switch housings, valve seats. Indicated uses: slide fastenings, grommets, gaskets.

Available in molding powder.

GENERAL PROPERTIES	
Specific gravity	1.08—1.14
MECHANICAL PROPERTIES	
Tensile strength (psi)	7,000—10,500
Compressive strength (psi)	18,000
Flexual strength (psi)	9,900—13,000
Impact strength (ft. lbs. per notch in.) (Izod)	0.94—1.4
Modulus of elasticity (psi $\times 10^5$)	3.3
Elongation (%)	54—280
Rockwell hardness	M90—R111
Stiffness (psi)	85,000—290,000
ELECTRICAL PROPERTIES	
Volume resistivity (ohms cms)	over 4.5×10^{13}
Dielectric strength (volts per mil)	375—385
Dielectric constant (60 cycles)	4.1
Dielectric constant (10^3 cycles)	4.0—4.2
Dielectric constant (10^6 cycles)	3.3—3.4
Power factor (60 cycles)	0.014
Power factor (10^3 cycles)	0.02—0.064
Power factor (10^6 cycles)	0.036—0.04
OPTICAL PROPERTIES	
Refractive index, N/D	1.53
Color range	Unlimited

THERMAL PROPERTIES	
Specific heat (cal. per °C per gram)	0.43—0.45
Thermal conductivity (Btu/hr/ft²/°F/in.	1.4—1.7
Thermal expansion (per °F $\times 10^{-5}$)	5.7—8
Distortion under heat (°F) (66 psi)	178—400
Burning rate	Self-extinguishing
Flow temperature (C)	Over 250
Deformation under load (%) 4000 psi, 122°F.	4—14
STABILITY	
Water absorption (% after immersion 24 hrs.)	0.53—1.5
Effect of age	Slight
Effect of sunlight	Slight discoloration
FABRICATING AND MOLDING DATA	
Molding qualities	Fair
Molding methods	Injection, Extrusion
Effect on metal inserts	Inert

EFFECT OF CHEMICALS

Soluble in cresol, phenol, formic acid, concentrated mineral acids; unaffected by weak alkalis and weak acids; decomposed by oxidizing acids

OUTSTANDING QUALITIES: Toughness, abrasion resistance, tensile strength, resiliency.

TYPICAL USES: Brush bristles, surgical sutures, fishing leaders, tennis and badminton racket strings.

GENERAL PROPERTIES

Specific gravity	1.08

MECHANICAL PROPERTIES

Tensile strength (psi)	45,000
Elongation (%)	25
Stiffness (psi)	450,000

ELECTRICAL PROPERTIES

Dielectric strength (volts per mil)	490
Dielectric constant (10^3 cycles)	4.5—6.3
Power factor (10^3 cycles)	2.7—11.7

OPTICAL PROPERTIES

Refractive index, N/D	1.5
Color range	Unlimite

THERMAL PROPERTIES

Specific heat (col. per °C per grom)	0.4
Burning rate	Self-extinguishin
Flow temperature (°C)	Over 20

STABILITY

Water absorption (% after immersion 24 hrs.)	3.
Effect of age	Non
Effect of sunlight	Slight discoloration; becomes britt

PHENOL FORMALDEHYDES

TYPE: Thermosetting.

General Purpose Grade

OUTSTANDING QUALITIES: Excellent electrical properties, good finish, high surface luster, heat and solvent resistance ease in molding, low cold flow, high tensile and flexural strength.

TYPICAL USES: Switch plates, sockets, door knobs, bottle caps and closures, radio cabinets, business machine housings vacuum cleaner parts, clock cases.

BAKELITE PHENOL FORMALDEHYDE (Bakelite)

Available in molding powder.

GENERAL PROPERTIES

	GRADE 11540
Specific gravity	1.32—1.47
Groms per cu. in	21.7—24.2

MECHANICAL PROPERTIES

Tensile strength (psi) (1/8" thick)	7,000—9,000
Flexurol strength (psi)	9,000—12,000
Impact strength (ft. lbs. per notch in.) (Izod) (milled notch in side)	0.24—0.32
Modulus of elasticity (psi × 10^5) (in flexure)	8—11
(Brinell hardness) Rockwell hardness	M110—M120

THERMAL PROPERTIES

Thermal conductivity (10^{-4} col./sq. cm./sec/°C)	4—7
Specific heat (col. per °C per gram)	0.35—0.40
Thermal coefficient of expansion lineor (per °C × 10^{-5})	3—4 mox.
Top operating temperature (°F)	300
Distortion under heat (°F)	275—300
Burning rate	Self-extinguishing

OPTICAL PROPERTIES

Refractive Index, N/D	Opaque
Color range	Limited to Dark Colors

ELECTRICAL PROPERTIES

	GRADE 11540
Volume resistivity (10^5 megohm cms.)	1—10
Dielectric strength (volts per mil) S/T 1/8"	200—375
Dielectric constant (60 cycles)	5.5—7
Dielectric constant (10^3 cycles)	4.8—6
Dielectric constant (10^6 cycles)	4.5—5.5
Power factor (60 cycles)	0.03—0.12
Power factor (10^3 cycles)	0.03—0.06
Power factor (10^6 cycles)	0.03—0.05

STABILITY

Tendency to cold flow	None
Water absorption (% gain in wt. 24 hrs. Immersion in water of room temp.)	0.3—0.7
Effect of age (indoor)	None

FABRICATING AND MOLDING DATA

Molding qualities	Good
Molding methods	Compression, Transfer, Plunger
Effect on metal Inserts	None

EFFECT OF CHEMICALS

Decomposed by strong acids and alkalies; reaction to weak acids and alkalies and organic solvents variable.

NEILLITE (Watertown Manufacturing Company)

Available in molding powder.

GENERAL PROPERTIES

	GRADE 300
Specific gravity	1.43
Grams per cu. in	23.3

MECHANICAL PROPERTIES

Compressive strength (psi)	29,000
Impact strength (ft. lbs. Per notch in.) (Izod)	0.34

ELECTRICAL PROPERITIES

Dielectric strength (volts per mil)	375
Dielectric constant (10^6 cycles)	4.65
Power factor (10^6 cycles)	0.035
Loss factor (10^6 cycles)	0.165

OPTICAL PROPERTIES

	GRADE 300
Light transmission	Opaque
Color range	Black

STABILITY

Water absorption (% after Immersion 24 hrs.)	0.65

FABRICATING AND MOLDING DATA

Molding qualities	Excelle
Molding methods	Compression, Transfe

EFFECT OF CHEMICALS

Decomposed by strong acids and alkalis; reaction to weak acids and alkalis and organic solvents variable.

Extend Life of Molds Improve Product Quality Increase Production

with MEGATHERM* ELECTRONIC HEATERS

The uniform heating and complete plasticity of plastics preforms achieved by Megatherm result in substantial advantages to the entire molding process.

Pressures are drastically reduced . . . from 25% to 30% . . . smaller presses may be used . . . there is less down-time . . . there are no flow marks.

This adds up to longer lasting molds and dies . . . better looking and better quality product . . . an increase in production . . . more customer satisfaction.

The illustrated switch case produced by American Insulator Corporation of New Freedom, Pa. shows the product superiority achieved by Megatherm preheating. This intricate part made from rag-filled Melmac weighs 7 pounds . . . measures 15½" x 9" x 3½". It has 20 metal inserts . . . was molded to exact dimensions and flawless finish under 300 ton pressure. The cover weighing 3 pounds was molded of Durez No. 791 under 200 ton pressure.

Extend the life of your molds . . . improve the quality of your product . . . increase your production — with Megatherm. Write for details *now*.

3 KW Megatherm Unit in the plant of the American Insulator Corp., New Freedom, Pa.

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ARMY-NAVY "E" — M

Federal Telephone and Radio Corporation

AN IT&T ASSOCIATE

Newark 1, N. J.

*Reg. U. S. Pat. Off.

DUREZ (Durez Plastics & Chemicals, Inc.)

Available in molding powder.

GENERAL PROPERTIES

Specific gravity	1.37
Grams per cu. in.	22.5

MECHANICAL PROPERTIES

Tensile strength (psi)	7,000
Compressive strength (psi)	32,000
Flexural strength (psi)	10,500
Impact strength (ft. lb. per notch in.) (izod)	0.30
Modulus of elasticity (psi $\times 10^5$)	10
Rockwell hardness, M scale	113

ELECTRICAL PROPERTIES

Volume resistivity (ohms cms)	1×10^{11}
Dielectric strength (volts per mil)	325
Dielectric constant (60 cycles)	8
Dielectric constant (10^3 cycles)	6.5
Dielectric constant (10^6 cycles)	5
Power factor (60 cycles)	0.3
Power factor (10^3 cycles)	0.12
Power factor (10^6 cycles)	0.05

OPTICAL PROPERTIES

Refractive index	Opaque
Color range	Dark Color

THERMAL PROPERTIES

Expansion (per °C)	44 × 10
Top operating temperature (°F)	37(
Distortion under heat (°F)	32(
Burning rate	Self-Extinguishing

STABILITY

Tendency to cold flow	Negligible
Water absorption (% after immersion 24 hrs.)	0.6
Effect of age	Negligible
Effect of sunlight	Colors Darken Slightly

EFFECT OF CHEMICALS

Decomposed by strong acids and alkalies; reaction to weak acids and alkalies and organic solvents variable.

FABRICATING AND MOLDING DATA

Molding qualities	Good
Molding methods applicable	Compression, Transfer
Machining qualities	Good
Effect on metal inserts	Negligible

MAKALOT MOLDING COMPOUNDS (Interlake Chemical Corporation)

Available in molding powder.

GENERAL PROPERTIES

Specific gravity	1.36—1.97
Grams per cu. in.	22.2—32.4

MECHANICAL PROPERTIES

Tensile strength (psi)	4,200—8,500
Compressive strength (psi)	20,000—36,000
Flexural strength (psi)	8,000—12,000
Impact strength (ft. lbs. per notch in.) (izod)	0.30—1.6

ELECTRICAL PROPERTIES

Volume resistivity (ohms cms)	10^{12}—10^{12}
Dielectric strength (volts per mil)	300—350
Dielectric constant (60 cycles)	5—12
Power factor (60 cycles)	0.04—0.30

OPTICAL PROPERTIES

Color range	Black, Brown

THERMAL PROPERTIES

Thermal conductivity (10^4 cal. sec., cm. °C)	4—12
Specific heat (cal. per °C per gram)	0.35—0.36
Thermal expansion (per °C)	3.7—7.5
Top operating temperature (°F)	450
Softening point (°F)	None
Distortion under heat	280-350
Burning rate	Very Low

STABILITY

Tendency to cold flow	None
Water absorption (% after immersion 24 hrs.)	0.05—0.6
Effect of age	None
Effect of sunlight	Light Colors Darken

FABRICATING AND MOLDING DATA

Molding qualities	Excellent
Molding methods	Compression, Transfer
Effect on metal inserts	None
Machining qualities	Good

EFFECT OF CHEMICALS

Decomposed by strong acids and alkalies; reaction to weak acids and alkalies and organic solvents variable. Insoluble in water and solvents.

Note: Makalot molding compounds are available in the following grades: General Purpose, Improved Impact, Low Loss, High Heat Resistance. The above table gives the range of values of these grades. Below are the values for the improved impact grade.

Improved Impact Grade

MAKALOT (Interlake Chemical Corporation)

Available in molding powder.

GENERAL PROPERTIES

	GRADE 1804
Specific gravity	1.36

MECHANICAL PROPERTIES

Tensile strength (psi)	7,100
Compressive strength (psi)	35,000
Flexural strength (psi)	11,600
Impact strength (ft. lbs. per notch in.) (izod)	0.46

ELECTRICAL PROPERTIES

Dielectric strength (volts per mil)	315

OPTICAL PROPERTIES

	GRADE 1804
Color range	Black

THERMAL PROPERTIES

Distortion under heat (°F)	275

STABILITY

Water absorption (% after immersion 24 hrs.)	0.50

MOLDING DATA

Molding qualities	Good

High Impact Grade

OUTSTANDING QUALITIES: Impact and flexural strength, heat resistance and insulation.

TYPICAL USES: Washing machine agitators, pulleys, housings, vacuum cleaner parts, telephone handsets, oil well drilling parts, hand wheels.

AKELITE PHENOL FORMALDEHYDE (Bakelite)

Available in molding powder.

GENERAL PROPERTIES	GRADE 3, 4
Specific gravity	1.36—1.40
Grams per cu. in.	22.4—23.0

MECHANICAL PROPERTIES	
Tensile strength (psi) (1/8" thick)	6,000—8,500
Flexural strength (psi)	9,000—14,000
Impact strength (ft. lbs. per notch in.) (Izod) (milled notch in side)	1.0—4.0
Modulus of elasticity (psi × 10^5)	10

ELECTRICAL PROPERTIES	
Volume resistivity (ohms cms) 10"	1—10
Dielectric strength (volts per mil) S/T	200—325
Dielectric constant (60 cycles)	7—10
Dielectric constant (10^3 cycles)	5.5—9.0
Dielectric constant (10^6 cycles)	5.0—6.0
Power factor (60 cycles)	0.10—0.25
Power factor (10^3 cycles)	0.04—0.12
Power factor (10^6 cycles)	0.04—0.06

OPTICAL PROPERTIES	GRADE 3, 4
Refractive index, N/D	Opaque
Color range	Limited to Dark Colors

THERMAL PROPERTIES	
Distortion under heat (°F)	250—300
Burning rate	Self-extinguishing

STABILITY	
Tendency to cold flow	None
Water absorption (% gain in wt. 24 hrs. immersion in water at room temp.)	0.70—1.20
Effect of age (indoors)	None

FABRICATING AND MOLDING DATA	
Molding qualities	Good
Molding methods	Compression, Transfer
Machining qualities	Fair
Effect of metal inserts	None

EFFECT OF CHEMICALS

Decomposed by strong acids and alkalies, reaction to weak acids and alkalies and organic solvents, variable.

RACKETT HI-1 (The Drackett Co.)

Available in molding compound.

GENERAL PROPERTIES	
Specific gravity	1.41
Odor	None
Taste	None

MECHANICAL PROPERTIES	
Tensile strength (psi)	6,700—8,000
Compressive strength (psi)	28,000—32,000
Flexural strength (psi)	10,000—16,000
Impact strength (ft. lbs. per notch in.) (Izod)	3.5—7.0
Modulus of elasticity (psi × 10^5)	16.0

STABILITY	
Tendency to cold flow	Nil
Water absorption (% after immersion 24 hrs.)	1.0
Effect of age	None
Effect of sunlight	None

ELECTRICAL PROPERTIES	
Dielectric strength (volts per mil)	275.0

OPTICAL PROPERTIES	
Light transmission (%)	Opaque
Color range	Dark Shades Only

THERMAL PROPERTIES	
Softening point (°F)	None
Distortion under heat (°F)	200
Burning rate	Very Low

FABRICATING AND MOLDING DATA	
Molding qualities	Excellent
Molding methods	Compression, Transfer Jet
Machining qualities	Good
Effect on metal inserts	None

EFFECT OF CHEMICALS

Decomposed by oxidizing acids and strong alkalies; reaction to weak acids and alkalies and organic solvents, none to slight.

UREZ (Durez Plastics & Chemicals, Inc.)

Available in molding powder.

GENERAL PROPERTIES	
Specific gravity	1.39—1.47
Grams per cu. in.	22.8—24.1

MECHANICAL PROPERTIES	
Tensile strength (psi)	5,000—6,000
Compressive strength (psi)	25,000—28,000
Flexural strength (psi)	8,000—12,000
Impact strength (ft. lb. per notch in.) (Izod)	0.8—2.5
Modulus of elasticity (psi × 10^5)	13
Rockwell hardness, M scale	107—108

ELECTRICAL PROPERTIES	
Volume resistivity (ohms cms)	1 × 10^{10}
Dielectric strength (volts per mil)	225—250
Dielectric constant (60 cycles)	9.5—10.5
Dielectric constant (10^3 cycles)	6.7—8.0
Dielectric constant (10^6 cycles)	5—6
Power factor (60 cycles)	0.3
Power factor (10^3 cycles)	0.12—0.15
Power factor (10^6 cycles)	0.06—0.07

OPTICAL PROPERTIES	
Refractive index	Opaque
Color range	Black, Natural

THERMAL PROPERTIES	
Expansion (per °C × 10^{-6})	22—33
Top operating temperature (°F)	350
Distortion under heat (°F)	330
Burning rate	Self-Extinguishing

STABILITY	
Tendency to cold flow	Negligible
Water absorption (% after immersion 24 hrs.)	0.8—1.0
Effect of age	Negligible
Effect of sunlight	Natural Color Darkens

EFFECT OF CHEMICALS

Decomposed by strong acids and alkalies; reaction to weak acids and alkalies and organic solvents variable.

FABRICATING AND MOLDING DATA	
Molding qualities	Good
Molding methods applicable	Compression, Transfer
Machining qualities	Good
Effect on metal inserts	Negligible

MICARTA (Westinghouse Electric Corporation)

OUTSTANDING QUALITIES: Grades 1321, 1345—Fairly low moisture absorption, good impact strength. Grade 1377—Mechanical strength, good moisture resistance, for simple designs.

TYPICAL USES: Grades 1321, 1345—Cone rollers, gear webs, terminal blocks. Grade 1377—Aircraft pulleys and control quadrants, bell cranks, bomb racks.

Available in laminated sheets, chopped impregnated cloth or paper, and combinations of these two forms.

MECHANICAL PROPERTIES	GRADES 1345 1321	GRADE 1377
Tensile strength (psi)	6,000	7,200
Compressive strength (psi)	29,000	30,000
Flexural strength (psi)	9,100	10,200
Shear strength (psi)	10,000	9,700
Impact strength (ft. lbs. per in. notch) (Charpy)	3.1	2.9
Brinell hardness	32—40	32—40
ELECTRIC PROPERTIES		
Dielectric strength (volts per mil)	250	250

THERMAL PROPERTIES	GRADES 1345 1321	GRADE 1377
Top operating temperature (°F)	212	212
STABILITY		
Water absorption (% gain in weight; 4 in. diam. × ⅛)	2.9	2.3
OPTICAL PROPERTIES		
Color range	Tan (1321); Black (1345)	Tan
FABRICATING AND MOLDING DATA		
Molding quality	Good	
Molding methods	Compression; Transfer	Compression; Transfer
Machining quality	Good	

Heat Resistant Grade

OUTSTANDING QUALITIES: Heat resistance, dimensional stability, low water absorption and cold flow, hardness.

TYPICAL USES: Cooking utensil handles, molded commutators, heater plugs, electric toaster base and fitments, closures.

BAKELITE PHENOL FORMALDEHYDE (Bakelite)

GENERAL PROPERTIES	GRADES 1 & 2
Specific gravity	1.65—2.20
MECHANICAL PROPERTIES	
Tensile strength (psi) (⅛" thick)	4,000—6,000
Flexural strength (psi)	7,000—10,000
Impact strength (ft. lbs. per notch in.) (Izod)	0.24—0.65
Modulus of elasticity in flexure (psi × 10^5)	15—25
ELECTRICAL PROPERTIES	
Volume resistivity (ohms cms) (for type 2)	0.20
Dielectric strength (volts per mil) (S/T ⅛")	200—300

OPTICAL PROPERTIES	GRADES 1 & 2
Color range	Brown, Black
THERMAL PROPERTIES	
Specific heat (cal. per °C per gram)	0.28—0.32
Thermal expansion (°C × 10^{-5})	1.5—2.2
Top operating temperature (°F)	350—450
Distortion under heat (°F)	285—350
STABILITY	
Water absorption (% gain in wt. 25 hrs. immersion in water at room temp.)	0.10—0.25
FABRICATING AND MOLDING DATA	
Molding qualities	Excellent Flow
Molding methods	Compression, Transfer, Plunger

DUREZ (Durez Plastics & Chemicals, Inc.)

GENERAL PROPERTIES	
Specific gravity	1.65—1.94
MECHANICAL PROPERTIES	
Tensile strength (psi)	5,500—6,000
Compressive strength (psi)	17,000—22,000
Flexural strength (psi)	8,500—9,500
Impact strength (ft. lb. per notch in.) (Izod)	0.30—0.34
Modulus of elasticity (psi × 10^5)	17—20
Rockwell hardness, M scale	107—110
ELECTRICAL PROPERTIES	
Volume resistivity (ohms cms)	1 × 10^{11}
Dielectric strength (volts per mil)	225—400
Dielectric constant (10^6 cycles)	6
Power factor (10^6 cycles)	0.04—0.07

OPTICAL PROPERTIES	
Color range	Black, Brown
THERMAL PROPERTIES	
Expansion (per °C × 10^{-6})	24
Top operating temperature (°F)	400—500
Distortion under heat (°F)	470
Burning rate	Self-Extinguishing
STABILITY	
Water absorption (% after immersion 24 hrs.)	0.1—0.6
EFFECT OF CHEMICALS	
Decomposed by strong acids and alkalies; reaction to weak acids and alkalies and organic solvents variable.	
FABRICATING AND MOLDING DATA	
Molding qualities	Good
Molding methods applicable	Compression, Transfer
Machining qualities	Fair
Effect on metal inserts	Negligible

REILLY INDUR (Reilly Tar & Chemical Corp.)

GENERAL PROPERTIES	
Specific gravity	1.36—2.0
MECHANICAL PROPERTIES	
Tensile strength (psi)	5,000—10,000
Compressive strength (psi)	24,000—36,000
Flexural strength (psi)	8,000—20,000
Impact strength (ft. lbs. per notch in.) (Charpy)	0.20
ELECTRICAL PROPERTIES	
Volume resistivity (ohms cms)	10^9—10^{11}
Dielectric strength (volts per mil)	200—500
Dielectric constant (10^6 cycles)	5—18
Power factor (10^6 cycles)	0.04—0.15

THERMAL PROPERTIES	
Distortion under heat (°F)	250—290
Burning rate	Non-flammable
STABILITY	
Water absorption (% after immersion 24 hrs.)	0.01—0.15
FABRICATING AND MOLDING DATA	
Molding qualities	Excellent
Molding methods	Compression
Decomposed by strong acids and strong alkalies; resistant to weak acids, weak alkalies and organic solvents variable.	

LOOKING FOR A "NO" MAN

Are you just a bit sick of the word "yes"? Are you fed up with people who tell you that something can be done when they know it can't, or shouldn't?

Would you like to meet an extruder who has--believe it or not—been known to turn down a job, and a profitable one at that, just because he was convinced that the job was not feasible?

We are of course talking about ourselves.

We don't like to say no. We prefer to say yes—and the scores of original developments pioneered by Detroit Macoid 'are proof positive that when we do say "yes" we mean it.

Leading executives in every field—automotive, refrigeration, furniture, toys—know Macoid is the most creative and reliable extruders in the business.

The best way to test these statements is by trying us out. *We are ready to back them all up.*

We also do injection molding.

DETROIT MACOID CORPORATION

12340 Cloverdale Ave.
Detroit, Michigan

MEMBER SOCIETY OF THE PLASTICS INDUSTRY SPI

ORIGINATORS OF
DRY PROCESS PLASTIC EXTRUSION

Low Loss Grade

OUTSTANDING QUALITIES: Low power factor, high dielectric strength and resistance to humidity.

TYPICAL USES: Radio insulation, electric insulation.

BAKELITE PHENOL FORMALDEHYDE (Bakelite)

Available in molding powder.

GENERAL PROPERTIES	GRADE BM-16981
Specific gravity	1.86—1.92
Grams per cu. in.	30.4—30.5
MECHANICAL PROPERTIES	
Tensile strength (psi)	4,500—6,000
Compressive strength (psi)	18,000—24,000
Flexural strength (psi)	9,000—11,000
Impact strength (ft. lbs. per notch in.) (Izod)	0.30—0.34

ELECTRICAL PROPERTIES	GRADE BM-1698
Power factor (10^3 cycles)	0.010—0.015
Power factor (10^6 cycles)	0.0065—0.0075
OPTICAL PROPERTIES	
Color range	Natur
STABILITY	
Water absorption (% after immersion 48 hours)	0.070
FABRICATING AND MOLDING DATA	
Molding qualities	Excellent
Molding methods	Compressio

DUREZ (Durez Plastics & Chemicals, Inc.)

Available in molding powder.

GENERAL PROPERTIES	GRADE 11863
Specific gravity	1.96
Grams per cu. in.	32
MECHANICAL PROPERTIES	
Tensile strength (psi)	5,000
Compressive strength (psi)	19,000
Flexural strength (psi)	10,000
Impact strength (ft. lb. per notch in.) (Izod)	0.34
Modulus of elasticity (psi × 10^5)	20
Rockwell hardness, M scale	104
ELECTRICAL PROPERTIES	
Volume resistivity (ohms cms)	1 × 10^{14}
Dielectric strength (volts per mil)	450
Dielectric constant (60 cycles)	5.1
Dielectric constant (10^3 cycles)	5.0
Dielectric constant (10^6 cycles)	4.7
Power factor (60 cycles)	0.02
Power factor (10^3 cycles)	0.02
Power factor (10^6 cycles)	0.007

OPTICAL PROPERTIES	GRADE 11863
Refractive index	Opaque
Color range	Natura
THERMAL PROPERTIES	
Expansion (per °C)	19 × 10
Top operating temperature (°F)	33
Distortion under heat (°F)	28
Burning rate	Self-Extinguishing
STABILITY	
Tendency to cold flow	Negligible
Water absorption (% after immersion 24 hrs.)	0.03
Effect of age	Negligible
Effect of sunlight	Natural Color Darke

EFFECT OF CHEMICALS

Decomposed by strong acids and alkalies; reaction to weak acids and alkalies and organic solvents variable.

FABRICATING AND MOLDING DATA

Molding qualities	Good
Molding methods applicable	Compression, Transfer
Machining qualities	Fair
Effect on metal inserts	Negligible

Special Grades

DUREZ (Durez Plastics & Chemicals, Inc.)

Available in molding powder.

OUTSTANDING QUALITIES: Excellent chemical resistance, extremely high finish, good machining properties.

TYPICAL USES: Parts subject to extreme chemical action, and requiring a smooth non-abrasive surface; rayon process equipment.

GENERAL PROPERTIES	GRADE 77SB
Specific gravity	1.25
Grams per cu. in.	20.5
MECHANICAL PROPERTIES	
Tensile strength (psi)	5,000
Compressive strength (psi)	30,000
Flexural strength (psi)	9,000
Impact strength (ft. lb. per notch in.) (Izod)	0.24
Modulus of elasticity (psi × 10^5)	9
Rockwell hardness, M scale	119
ELECTRICAL PROPERTIES	
Volume resistivity (ohms cms)	1 × 10^{14}
Dielectric strength (volts per mil)	270
Dielectric constant (60 cycles)	6.7
Dielectric constant (10^3 cycles)	6.6
Dielectric constant (10^6 cycles)	4.7
Power factor (60 cycles)	0.11
Power factor (10^3 cycles)	0.05
Power factor (10^6 cycles)	0.035
OPTICAL PROPERTIES	
Refractive index	Opaque
Color range	Black

THERMAL PROPERTIES	GRADE 77SB
Expansion (per °C × 10^{-6})	49
Top operating temperature (°F)	37
Distortion under heat (°F)	330
Burning rate	Self-Extinguishing
STABILITY	
Tendency to cold flow	Negligible
Water absorption (% after immersion 24 hrs.)	0.4
Effect of age	Negligible
Effect of sunlight	None

EFFECT OF CHEMICALS

Best possible chemical resistance for phenolics. Unaffected by strong acids and weak alkalies.

FABRICATING AND MOLDING DATA

Molding qualities	Good
Molding methods applicable	Transfer, Compression
Machining qualities	Good
Effect on metal inserts	Negligible

66, MH-66, MF-66 MOLDING POWDERS (Heresite & Chemical Company)

OUTSTANDING QUALITIES: High chemical and heat resistance, low water absorption, dimensional stability, good electrical properties.

TYPICAL USES: Rayon machine parts, electrical equipment, laboratory ware.

Available in molding powder.

NERAL PROPERTIES

Specific gravity	1.28—1.35
Odar	Nane
Taste	Nane

CHANICAL PROPERTIES

Tensile strength (psi)	8,000—10,000
Compressive strength (psi)	20,000—25,000
Flexural strength (psi)	12,000—15,000
Impact strength (ft. lbs. per notch in. (Izad)	0.2—0.56
Madulus af elasticity (psi × 10^5)	12—18
Rockwell hardness	M100—M120

CTRICAL PROPERTIES

Dielectric strength (valts per mil)	200—400

THERMAL PROPERTIES

Tap aperating temperature (°F.)	450
Softening paint (°F)	Nane
Distortion under heat (°F)	250—290
Burning rate	Very Law to Nii

STABILITY

Tendency ta cald flaw	Nane
Water absarptian (% after immersion 24 hrs.)	0.1—0.2

FABRICATING AND MOLDING DATA

Malding qualities	Gaod
Malding methads	Compression, Transfer
Machining qualities	Good
Effects an metal inserts	Nane

EFFECT OF CHEMICALS

Insaluble in all salvents; resistant ta acids, alkalies and salts.

SINOX (Monsanto Chemical Co., Plastics Div.)

OUTSTANDING QUALITIES: This table covers the entire range of properties of the phenol formaldehyde group. The various grades listed above are included in its scope.

TYPICAL USES: Listed above for the various grades.

Available in molding powder.

ENERAL PROPERTIES

Specific Gravity	1.35—1.75
Grams per cu. in.	21—31
Odor	Very Slight ta Marked
Taste	Very Slight to Marked

ECHANICAL PROPERTIES

Tensile strength (psi)	4,200—9,500
Compressive strength (psi)	20,000—35,000
Flexural strength (psi)	8,000—15,000
Impact strength (ft. lbs. per notch in. (Izod)	0.26—8.00
Madulus af elasticity, (psi × 10^5)	8—45
Elangatian (%)	Nane
Rackwell hardness	M85—M125

ECTRICAL PROPERTIES

Volume resistivity (ahm cms)	10^9—10^{12}
Dieletric strength (volts per mil) short time	250—500
step wise	200—400
Dielectric constant (60 cycles)	5—20
Dielectric canstant (10^3 cycles)	4—20
Dielectric canstant (10^6 cycles)	4.5—20
Power factor (60 cycles)	0.04—0.30
Power factar (10^3 cycles)	0.04—0.20
Pawer factar (10^6 cycles)	0.009—0.10

OPTICAL PROPERTIES

Refractive Index, N/D	None
Light transmissian (%)	None
Calar range	Limited

THERMAL PROPERTIES

Thermal canductivity (cal. sec., cm. °C × 10^{-4})	3—20
Specific heat (cal. per °C per gram)	0.25—0.36
Thermal expansian (per °C × 10^{-5})	2.0—7.5
Tap aperating temperature (°F)	230—450
Softening paint (°F)	None
Distartian under heat (°F)	240—285
Burning rate	Very Low to Moderate

STABILITY

Tendency to cold flaw	Nane ta Very Slight
Water absorptian (% after immersian 24 hrs)	0.03—1.5

FABRICATING AND MOLDING DATA

Malding qualities	Fair ta Excellent
Molding methads	Compression, Transfer
Machining qualities	Fair to Gaod
Effect on metal inserts	Nane

EFFECT OF CHEMICALS

Decampased by strong acids and alkalies; reacts ta weak acids and alkalies; Insaluble in camman arganic salvents.

PHENOL FURFURALS (and PHENOL FORMALDEHYDES)

TYPE: Thermosetting.

URITE (Durite Plastics)

OUTSTANDING QUALITIES: Excellent electrical properties, heat and solvent resistant, low cold flow, tensile strength; impact resistance grade excels in shock resistance.

TYPICAL USES: Switch plates, sockets, door knobs, bottle caps, business machine housings.

General Purpose Grade (Wood Flour Filler)

Available in molding pawder.

ENERAL PROPERTIES

Specific gravity	1.32—1.42

ECHANICAL PROPERTIES

Tensile strength (psi)	5000—8500
Compressive strength (psi)	16,000—36,000
Flexural strength (psi)	8,000—15,000
Impact strength (ft. lbs. per notch in.) (Izad)	0.2—0.4
Madulus af elasticity (psi × 10^5)	10—25
Rackwell hardness	M100—M110

LECTRICAL PROPERTIES

Volume resistivity (ahms cms)	10^9—10^{12}
Dielectric strength (valts per mil) short time	300—550
stepwise	200—350
Dielectric canstant (10^6 cycles)	4.5—9
Pawer factar (10^3 cycles)	0.04—0.28
Pawer factar (10^6 cycles)	0.03—0.10

THERMAL PROPERTIES

Specific heat (cal. per °C per gram)	0.3—0.4
Thermal expansion (10^{-5} per °C)	3—7
Tap aperating temperature (°F)	300
Softening point (°F)	None
Distartian under heat (°F)	240—300
Burning rate	Very Low

STABILITY

Water absarptian (% after immersion 24 hrs.)	0.2—0.6

FABRICATING AND MOLDING DATA

Malding qualities	Excellent
Malding methads applicable	Compression
Machining qualities	Fair to Good

EFFECT OF CHEMICALS

Decamposed by strang alkalies and oxidizing acids; inert ta reducing and arganic acids; slightly affected by weak alkalies.

Impact Resistance Grade (Fabric Filler)

DURITE (Durite Plastics)

Available in molding powder.

GENERAL PROPERTIES

Specific gravity	1.3—1.45

MECHANICAL PROPERTIES

Tensile strength (psi)	5500—8000
Compressive strength (psi)	20,000—32,000
Flexural strength (psi)	8000—13,000
Impact strength (ft. lbs. per notch in.) (Izod)	0.6—4.8
Modulus of elasticity, (psi × 10^5)	7—12
Rockwell hardness	B65—B75

ELECTRICAL PROPERTIES

Volume resistivity (ohms cms)	10^9—10^{11}
Dielectric strength (volts per mil) short time	150—450
stepwise	100—350
Dielectric constant (10^6 cycles)	4.5—8
Power factor (10^6 cycles)	0.03—0.10

THERMAL PROPERTIES

Thermal conductivity (10^{-4} cal. sec., cm. °C)	3—8
Thermal expansion (10^{-5} per °C)	2—5
Tap operating temperature (°F)	240—300
Softening point (°F)	None
Distortion under heat (°F)	240—285

STABILITY

Water absorption (% after immersion 24 hrs.)	0.5—2.5
Effect of age	Hardens slightly
Effect of sunlight	Light Colors Discolor

FABRICATING AND MOLDING DATA

Molding methods	Compression
Machining qualities	Fair to Good
Effect on metal inserts	Inert

EFFECT OF CHEMICALS

Decomposed by strong alkalies and oxidizing acids; inert to reducing and organic acids; slightly affected by weak alkalies.

Note: These values cover both Durite Phenol Furfurol and Phenol Formaldehyde molding compounds.

POLYSTYRENES

TYPE: Thermoplastic.

OUTSTANDING QUALITIES: Excellent electrical properties, chemical inertness, negligible water absorption, low specific gravity, good colorability, stability at low temperatures.

TYPICAL USES: Electrical insulation, high frequency equipment, refrigerator and radio parts, closures, containers, imitation jewels, combs, toys, chemical containers.

BAKELITE POLYSTYRENE (Bakelite Corporation)

Available in molding powder.

GENERAL PROPERTIES

Specific gravity	1.07

MECHANICAL PROPERTIES

Tensile strength (psi)	6,500—7000 (Note 1)
Flexural strength (psi)	14,000—19,000 (Note 1)
Impact strength (ft. lbs. per notch in.) (Izod)	0.8—1.2 (Note 1)
Modulus of elasticity (psi × 10^5)	3.75—4.25 (Note 1)
Rockwell hardness	M85—M92

ELECTRICAL PROPERTIES

Volume resistivity	over 10^9 megohms
Dielectric strength (60 cycles) (volts per mil) (step by step)	500—525
Dielectric constant (60 cycles)	2.50—2.60
Dielectric constant (10^3 cycles)	2.50—2.60
Power factor (10^6 cycles)	0.0001—0.0004
Loss factor at 10^7 cycles	0.00025—0.0010

OPTICAL PROPERTIES

Refractive index, N/D	1.592—1.597
Color range	Wide

THERMAL PROPERTIES

Specific heat (cal. per °C per gram)	0.32
Thermal expansion (per °C × 10^{-5})	6.5—7.5
Distortion under heat (°F)	170.6—176

STABILITY

Water absorption (% after immersion 318 hrs., 2½" disc)	0.05

FABRICATING AND MOLDING DATA

Molding methods	Compression, injection
Effect on metal inserts	inert

EFFECT OF CHEMICALS

Excellent resistance to non-oxidizing acids and alkalies.

Note 1: Value for injection molded products. Following are values for corresponding properties of compression molded type: Tensile strength—5500-6500; Impact strength (Izod)—0.40-0.70; Flexural strength—6500-7500; Modulus of elasticity—4-6×10^5.

CHEMACO (Chemaco Corp.)

Available in molding powder.

GENERAL PROPERTIES

Specific gravity	1.05—1.07
Odor	None
Taste	None

ELECTRICAL PROPERTIES

Volume resistivity (ohms cms)	10^{17}—10^{19}
Dielectric constant (60 cycles)	2.5—2.6
Dielectric constant (10^3 cycles)	2.5—2.6
Dielectric constant (10^6 cycles)	2.5—2.6
Power factor (60 cycles)	0.0001—0.0002
Power factor (10^6 cycles)	0.0001—0.0004

OPTICAL PROPERTIES

Refractive index, N/D	1.59
Light transmission (%)	88—92
Color range	Unlimited

STABILITY

Tendency to cold flow	Very Slight
Water absorption (% after immersion 24 hrs.)	None
Effect of age	Practically None
Effect of sunlight	Yellows Slightly

MECHANICAL PROPERTIES

Tensile strength (psi)	5,000—9,000
Compressive strength (psi)	11,500—13,500
Flexural strength (psi)	8,000—19,000
Impact strength (ft. lbs. per notch in.) (Izod)	0.35—0.50
Modulus of elasticity, (psi × 10^5)	3.9—4.7
Elongation (%)	2—5
Rockwell hardness	M87—M90

THERMAL PROPERTIES

Thermal conductivity (10^{-4} cal. sec., cm °C)	1.9
Specific heat (cal. per °C per gram)	0.32
Thermal expansion (per °C × 10^{-5})	6—8
Softening point (°F)	190—250
Distortion under heat (°F)	162—180

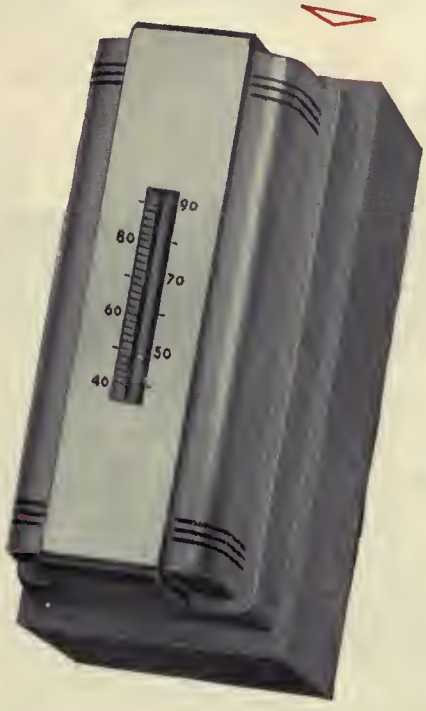
FABRICATING AND MOLDING DATA

Molding qualities	Excellent
Molding methods	Compression, injection, Extrusion
Machining qualities	Fair to Good
Effect on metal inserts	inert

EFFECT OF CHEMICALS

Soluble in esters, aromatic hydrocarbons; resistant to corrosive acids, mineral acids, organic acids, inorganic salts, alkalies, glycerine, naphtha, glycols, most alcohols, aliphatic hydrocarbons.

RAISED LINES, STEPS AND LETTERS — IN — Hobbed Cavities by Midland



When you have a mold problem that ombines intricate details and complications, ring it to Midland. Over the years we ave developed the special skills necessary o make perfect hobbed cavities of the lifficult-to-make variety. Shown above is a nob and cavity by Midland that includes raised lines, steps, and letters.

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Makers of Plastic Molds • Die Cast Molds • Engraved Dies • Steel Stamps • Hobbings • Pantograph Engraving

LOALIN (Catalin Corporation)

Available in molding powder.

GENERAL PROPERTIES

Specific gravity	1.05—1.07
Grams per cu. in.	17.2—17.5
Odor	None
Taste	None

MECHANICAL PROPERTIES

Tensile strength (psi)	5,000—9,000
Transverse strength (psi)	14,000—16,000
Flexural strength (psi)	8,000—9,500
Impact strength (ft. lbs. per notch in.) (Izod)	0.50—0.60
Modulus of elasticity (psi × 10^5)	4.0—4.7
Elongation (%)	2.0—3.0
Shear strength (psi)	6,000—7,000
Rockwell hardness	M87—M90

ELECTRICAL PROPERTIES

Volume resistivity (ohms cms)	10^{17}—10^{19}
Dielectric constant (60 cycles)	2.5—2.6
Dielectric constant (10^3 cycles)	2.5—2.6
Dielectric constant (10^6 cycles)	2.5—2.6
Power factor (60 cycles)	0.0001—0.0003
Power factor (10^3 cycles)	0.0001—0.0003
Power factor (10^6 cycles)	0.0001—0.0003

OPTICAL PROPERTIES

Refractive index, N/D	1.59
Light transmission (%)	88—90
Color range	Unlimited

THERMAL PROPERTIES

Thermal conductivity (10^{-4} cal. sec., cm. °C)	1.9
Specific heat (cal. per °C per gram)	0.32
Thermal expansion (per °C)	65—75
Softening point (°F)	190—250
Distortion under heat (°F)	175—185
Burning rate	Slow

STABILITY

Water absorption (% after immersion 24 hrs.)	0.00
Effect of age	Very Slight
Effect of sunlight	Yellows Slightly

FABRICATING AND MOLDING DATA

Molding qualities	Excellent
Molding methods	Injection
Effect on metal inserts	Inert

EFFECT OF CHEMICALS

Inert to corrosive acids, mineral acids, organic acids, inorganic salts, alkalies; soluble in benzine, styrene, turpentine, dioxane, ethylene chloride, cellosolve acetate, carbon tetrachloride, aromatic and chlorinated hydrocarbons.

LUSTRON (Monsanto Chemical Co., Plastics Div.)

Available in molding powder.

GENERAL PROPERTIES

Specific gravity	1.054—1.070
Grams per cu. in.	17.2—17.5
Odor	None
Taste	None

MECHANICAL PROPERTIES

Tensile strength (psi)	5,500—7,000
Compressive strength (psi)	14,000—16,000
Flexural strength (psi)	8,000—9,500
Impact strength (ft. lbs. per notch in.) (Izod)	0.3—0.4
Modulus of elasticity (psi × 10^5)	1.7—4.7
Elongation (%)	2—3
Shear strength (psi)	6,000—7,000
Rockwell hardness	M80—M95

ELECTRICAL PROPERTIES

Volume resistivity (ohms cms)	10^{17}—10^{19}
Dielectric strength (volts per mil)	500—700
Dielectric constant (60 cycles)	2.5—2.6
Dielectric constant (10^3 cycles)	2.5—2.6
Dielectric constant (10^6 cycles)	2.5—2.6
Power factor (60 cycles)	0.0001—0.0002
Power factor (10^3 cycles)	0.0001—0.0003
Power factor (10^6 cycles)	0.0001—0.0003

OPTICAL PROPERTIES

Refractive index, N/D	1.59
Light transmission (%)	88—92
Color range	Unlimited

THERMAL PROPERTIES

Thermal conductivity (10^{-4} cal. sec., cm. °C)	1.9
Specific heat (cal. per °C per gram)	0.32
Thermal expansion (per °C × 10^{-5})	6—8
Top operating temperature (°F)	150—170
Softening point (°F)	190—230
Distortion under heat (°F)	168—176
Burning rate	Moderate

STABILITY

Tendency to cold flow	Slight
Water absorption (% after immersion 24 hrs.)	0.05
Effect of age	Very Slight
Effect of sunlight	Yellows Slightly

FABRICATING AND MOLDING DATA

Molding qualities	Excellent
Molding methods	Compression, Injection, Extrusion
Machining qualities	Good to Excellent
Effect on metal inserts	None

EFFECT OF CHEMICALS

Soluble in aromatic and chlorinated hydrocarbons; resistant to acids and alkalies, lower alcohols.

STYRON (Dow Chemical Company)

Available in molding powder.

GENERAL PROPERTIES

Specific gravity	1.052—1.055
Grams per cu. in.	17.2—17.5
Odor	Very Slight to None
Taste	None

MECHANICAL PROPERTIES

Tensile strength (psi)	5,000—10,000
Compressive strength (psi)	10,000—16,000
Impact strength (ft. lbs. per notch in) (Izod)	0.26—0.6
(Charpy)	0.28—0.6
Modulus of elasticity, (psi × 10^5)	3.0—5.6
Elongation (%)	1.5—4.0
Rockwell hardness	M80—M90

ELECTRICAL PROPERTIES

Volume resistivity (ohms cms)	10^{17}—10^{19}
Dielectric strength (volts per mil)	Short time, 500—700
	Stepwise, 400—600
Dielectric constant (60 cycles)	2.5—2.6
Dielectric constant (10^3 cycles)	2.5—2.7
Dielectric constant (10^6 cycles)	2.5—2.6
Power factor (60 cycles)	0.0001—0.0003
Power factor (10^3 cycles)	0.0001—0.0003
Power factor (10^6 cycles)	0.0001—0.0004

OPTICAL PROPERTIES

Refractive index, N/D	1.59
Light transmission (%)	88—92
Color range	Unlimited

THERMAL PROPERTIES

Thermal conductivity (Cals/cm^2/Sec/°C/cm × 10^{-4})	2.47—3.29
Specific heat (cal. per °C per gram)	0.32
Thermal expansion (per °C × 10^{-5})	6—8
Distortion under heat (°F)	165—190
Burning rate	Slow

STABILITY

Tendency to cold flow	Very Slight
Water absorption (% after immersion 24 hrs.)	.05
Effect of age	None
Effect of sunlight	Slight

FABRICATING AND MOLDING DATA

Molding qualities	Excellent
Molding methods	Injection
Machining qualities	Fair to good
Effect on metal inserts	
Chemical effect on	Inert
Use in molded articles	Good

EFFECT OF CHEMICALS

Resistant to practically all alcohols; acids, alkalies and salts; and water.

Another Example

of BETTER COMPRESSION MOLDING with McKEE AUTOMATIC Gas-Fired Steam Boiler

IN compression molding of plastics parts, the vitally important precision-control of temperature and pressure are obtained with the McKee Gas-Fired Steam Boiler. This quickly responsive boiler with its highly adaptable gas-firing and control instruments, gives you the most dependable steam process heating unit. Read what the Vard Mechanical Laboratories of Pasadena, California say about their McKee Boiler:

"The acrylic resin material molded by us to produce the new transparent drafting scales must be carefully controlled both as to temperature and pressure during its forming. The quiet and efficient manner in which the McKee Boiler performs its part is really appreciated by the operator responsible for the scale molding."

To meet your particular compression molding requirements, there is a complete line of McKee Industrial Process Boilers — 50° F. to 650° F. Working Temperature.

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2 applications

that illustrate the great versatility of PLASKON materials

Investigate the many advantages of Plaskon Materials—they may be the answer to your problems involving manufacturing economies, new product applications, wider ranges of service, and entirely new designs.
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PLASKON UREA-FORMALDEHYDE COMPOUNDS

1. Wide range of lightfast hues, from translucent natural and pure white to jet black.
2. Smooth surface, eye-catching, warm to touch.
3. Completely resistant to common organic solvents, impervious to oils and grease.
4. Possesses high flexural, impact and tensile strength.
5. Highly resistant to arcing and tracking under high voltages and high frequencies.

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1. Assures ample protection where water or high humidity prevent the use of urea compounds.
2. Exceptional resistance to acids and alkalies. Non-porous, non-corrodible.
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★ MATERIALS ★

1

is new plastic pot cleaner, made by Downy ducts Company, Orange, N. J., utilizes skon Resin, a product of Plaskon Divi- n, Libbey-Owens-Ford Glass Company. ousands of tiny plastic heads are firmly chored to minute cotton loops that hold p while working at extreme speed. This ovides power for scouring. The cleaner is olly flexible and manageable, and will t crack, splinter or break off.

Of first importance is the fact that the new cleaner completely removes the hazards of infection that were constantly present when metallic cleaners were employed. These hazards were so real that several states passed restrictive legislation against the use of such cleaners.

The non-metallic characteristics of this new cleaner suggest a variety of uses other than the scouring of pots and pans. These include the paring of rooty vegetables, cleaning tile, linoleum, and porcelain and enamelware. It also should prove effective as a pre-paint, rubdown abrasive for wood and metal surfaces, while still other uses would include the cleaning of garage and garden equipment, and dairy and farm utensils, industrial buffing, etc.

2

new wall switch plate that should reduce ome accidents and greatly contribute to the etterment of short tempers was recently arketed by Associated Projects Company f Columbus, Ohio.

Made of molded Plaskon, the new switch late is equipped with a tiny lamp that lows when the lights it controls are out; oes off automatically when the lights are witched on.

The "LumiNite" switch plate spells an end to fumbling for switches in the dark, provides a subdued safety glow that prevents stumbling over objects that would otherwise be unseen, keeps walls free of smudges from hands groping for switches, shows when one has forgotten to turn off remote lights, and serves as a night-light in nursery or bedroom.

Another advantage of the LumiNite is that its rich, ivory plastic finish blends perfectly into any decorative scheme. The Plaskon material is a non-conductor of electricity; cannot rust, tarnish or corrode; and can be kept clean and bright with a damp cloth.

POLYSTYRENES (Modified)

TYPE: Thermoplastic.

CEREX (Monsanto Chemical Co., Plastics Div.)

OUTSTANDING QUALITIES: High heat distortion point, dimensional stability, chemical resistivity.

TYPICAL USES: Coil forms, battery jars, switch parts, surgical instruments requiring sterilization. Indicated uses: plumbing hardware, electronic apparatus parts, sterilizable combs.

Available in molding powder.

GENERAL PROPERTIES

Specific gravity	1.07

MECHANICAL PROPERTIES

Flexural strength (psi)	13,000
Impact strength (ft. lbs. per notch in.) (Izod)	0.40
Rockwell hardness	M100

ELECTRICAL PROPERTIES

Dielectric strength (volts per mil)	510
Dielectric constant (10^3 cycles)	2.72
Dielectric constant (10^6 cycles)	2.76
Power factor (10^3 cycles)	0.0024
Power factor (10^6 cycles)	0.0024

OPTICAL PROPERTIES

Color range	Extensive
Clarity	Amber, Transparent

THERMAL PROPERTIES

Top operating temperature (°F)	250
Distortion under heat (°F)	212—230

STABILITY

Water absorption (% after immersion 24 hrs.)	0.3

FABRICATING AND MOLDING DATA

Molding qualities	Injection—Good; Compression not recommended for production
Molding methods	Injection, Compression, Transfer

EFFECT OF CHEMICALS

Unaffected by weak acids, weak bases; attacked by strong oxidizing acids; soluble in aromatic and chlorinated hydrocarbons.

STYRAMIC (Monsanto Chemical Co., Plastics Div.)

OUTSTANDING QUALITIES: Excellent electrical properties, chemical inertness, negligible water absorption, stability at low temperatures, non-flammability, heat resistance.

TYPICAL USES: Electrical insulation for high frequency and radio equipment.

Available in molding powder.

GENERAL PROPERTIES

Specific gravity	1.358

MECHANICAL PROPERTIES

Tensile strength (psi)	3,000—3,500
Compressive strength (psi)	11,300
Flexual strength (psi)	6,500—7,000
Impact strength (ft. lbs. per notch in.) (Chorpy)	0.42
Elongation (%)	0.97
Rockwell hardness	M-72

ELECTRICAL PROPERTIES

Dielectric strength (volts per mil)	800
Dielectric constant (60 cycles)	2.55
Power factor (300 kilocycles, %)	0.04

OPTICAL PROPERTIES

Light transmission (%)	Opaque

THERMAL PROPERTIES

Top operating temperature (°F)	170—210
Distortion under heat (°F)	184—187
Burning rate	Non-flammable

STABILITY

Tendency to cold flow	Very Slight
Water absorption (% after immersion 24 hrs.)	0.046
Effect of sunlight	Very Slight

FABRICATING AND MOLDING DATA

Molding qualities	Good
Molding methods	Compression, Injection, Extrusion
Machining qualities	Good
Effect on metal inserts	None

EFFECT OF CHEMICALS

Insoluble in lower alcohols, acids, alkalies; soluble in aromatics, chlorinated hydrocarbons; resistant to alkalies and non-oxidizing acids.

POLYSTYRENE-COPOLYMER (Elastomeric)

STYRALOY (Dow Chemical Company)

OUTSTANDING QUALITIES: High dielectric strength, low power loss, lightness, low temperature flexibility and shock resistance.

TYPICAL USES: Tool handles, household appliances, gaskets, coil forms, scuff plates, wire insulation, tapes.

Available in molding powder.

GENERAL PROPERTIES

Specific gravity	0.95—0.97

MECHANICAL PROPERTIES

Tensile strength (psi)	900—1,200
Impact strength (ft. lbs. per notch in.) (Izod)	1.5—1.8
Elongation (%)	10—35

ELECTRICAL PROPERTIES

Volume resistivity (ohms cms.)	10^{16}
Dielectric strength (volts per mil)	3,000
Dielectric constant (10^3 cycles)	2.4—2.5
Dielectric constant (10^6 cycles)	2.4—2.5
Power factor (10^3 cycles)	0.07—0.12
Power factor (10^6 cycles)	0.05—0.10

OPTICAL PROPERTIES

Color range	Limited

THERMAL PROPERITIES

Thermal conductivity (Cal/sec/°C/cm/cm $\times 10^{-4}$)	4—7
Specific heat (cal. per °C per grom)	0.40—0.56
Thermal expansion (per °C $\times 10^{-4}$) (to 84 °C)	1.79
Distortion under heat (°F)	140—149
Burning rate (inch per min.)	2.4

STABILITY

Water absorption (% after immersion 24 hrs.)	0.2—0.5
Effect of sunlight	Darkens Slightly

FABRICATING AND MOLDING DATA

Molding qualities	Good
Molding methods	Compression, Injection, Extrusion, Calender
Machining qualities	Excellent

EFFECT OF CHEMICALS

Gells in acetone, ethyl acetate, ethylene dichloride, carbon tetrachloride, toluene, and heptane; good resistance to sulfuric acid, sodium hydroxide, ethyl alcohol, nitric acid, hydrochloric acid, ammonium hydroxide, hydrogen peroxide.

POLYETHYLENES

TYPE: Thermoplastic.

OUTSTANDING QUALITIES: Excellent electrical properties, resistance to chemicals, low moisture absorption, low specific gravity, excellent low temperature properties, excellent impact strength.

TYPICAL USES: Co-axial cable insulation, underground wire insulation, grommets, waterproofing and chemically resistant coating, bottle cap liners. Indicated uses: Screens, trim, picnic ware, automobile hardware, acid resistant gloves and clothing, shoe soles, printing plates, gaskets, battery parts, ice-cube trays.

POLYETHYLENE (Bakelite Corporation)

Available in sheet, tube, molding powder, monofilaments.

GENERAL PROPERTIES

Specific gravity	0.92
Grams per cu. in	15.04

MECHANICAL PROPERTIES

Tensile strength (psi)	1,800
Brittle temperature, °C	Below—70
Stiffness in flexure (psi) 25°C	18,000
Elongation (%)	500

ELECTRICAL PROPERTIES

Volume resistivity (ohms cms)	Greater than 10^{15}
Dielectric strength (volts per mil) $\frac{1}{8}$" thick	400—475
Dielectric constant (10^6 cycles)	2.3
Power factor (10^6 cycles)	0.00030

THERMAL PROPERTIES

Thermal conductivty [10^{-4} cal. (sec.)$^{-1}$(cm)$^{-1}$(°C)$^{-1}$] (0-15 °C)	8.1
Specific heat (cal per °C per gram)	0.53
Burning rate	Slow

STABILITY

Water absorption (% after immersion 24 hrs.)	0.01
Effect of sunlight	No Discoloration

FABRICATING AND MOLDING DATA

Molding methods	Compression, Injection
Machining qualities	Excellent

EFFECT OF CHEMICALS

Insoluble in all common solvents below 50-60°C; soluble in chlorinated solvents, aliphatic and aromatic hydrocarbons at elevated temperatures.

NOTE: These are average properties of typical compounds. A great many different compounds with varying properties are practical.

POLYTHENE (duPont Plastics Dept.)

Available in sheet, molding powder, film, fiber, tube.

GENERAL PROPERTIES

Specific gravity	0.92
Odor	None
Taste	None

MECHANICAL PROPERTIES

Tensile strength (psi)	1,900
Compressive strength (psi)	3,000
Impact strength (ft. lbs. per notch in.) (Izod)	.4
Modulus of elasticity, (psi × 10^5)	13,000
Elongation (%)	600
Shear strength (psi)	1,500
Rockwell hardness	R36
Stiffness (psi)	13,000

THERMAL PROPERTIES

Thermal conductivity (Btu/hr./ft^2/°F/in.)	2.2
Specific heat (cal. per °C per gram)	0.55
Thermal expansion (per °F × 10^{-5})	9
Distortion under heat (°F) 66 psi	107
Flow temperature (°C)	106
Burning rate (in. per min.)	1.1
Deformation under load (%) 100 psi, 122°F	0.6

ELECTRICAL PROPERTIES

Volume resistivity (ohms cms)	Over 10^{13}
Dielectric strength (volts per mil)	460
Dielectric constant (60 cycles)	2.3
Dielectric constant (10^3 cycles)	2.3
Dielectric constant (10^6 cycles)	2.3
Power factor (60 cycles)	Under 0.0005
Power factor (10^3 cycles)	Under 0.0005
Power factor (10^6 cycles)	Under 0.0005

OPTICAL PROPERTIES

Refractive index, N/D	1.51
Color range	Limited

STABILITY

Water absorption (% after immersion 24 hrs.)	Under 0.005
Effect of age	None
Effect of sunlight	No discoloration

FABRICATING AND MOLDING DATA

Molding qualities	Good
Molding methods	Compression, Extrusion, Injection

EFFECT OF CHEMICALS

Resists almost all chemical reagents at room temperature. Very slowly attacked by concentrated nitric acid. To some extent attacked by certain aromatic, aliphatic, or halogenated hydrocarbons.

POLYVINYL ACETALS

TYPE: Thermoplastic.

OUTSTANDING QUALITIES: Toughness, dielectric strength, lightness.

TYPICAL USES: Toilet items, phonograph records, tiles, arch supports, shoe heels, printing plates, insulation.

VAR (Shawinigan Products Corp.)

Available in molding powder.

GENERAL PROPERTIES

Specific gravity	1.16
Grams per cu. in	19.3

MECHANICAL PROPERTIES

Tensile strength (psi)	6,000—9,000

ELECTRICAL PROPERTIES

Dielectric strength (volts per mil)	950

THERMAL PROPERTIES

Thermal conductivity (10^{-5} cal. sec. cm. °C)	44
Specific heat (cal. per °C per gram)	0.29
Thermal expansion (per °C × 10^{-5})	6.5
Tap operating temperature (°F)	302
Softening point (°F)	275—374
Distortion under heat (°F)	167—194
Burning rate	Slow

STABILITY

Water absorption (% after immersion 24 hrs.)	2.0

POLYVINYL BUTYRALS

TYPE: Thermaplastic.

OUTSTANDING QUALITIES: Taughness, extensibility; resistance ta light, heat and water; retains flexibility and taughness, over wide temperature range; capable af madificatian ta have therma-setting praperties.

TYPICAL USES: Sheets: Safety glass interlayer. Flakes: Fabric caatings (haspital sheeting, raincoats, etc.); impregnation for tarpaulins; plywoad adhesive.

BUTACITE (duPont Plastics Dept.)

Available in sheets and flakes.

GENERAL PROPERTIES

Specific gravity	1.1—1.2

MECHANICAL PROPERTIES

Tensile strength (psi)	7,000
Flexural strength (psi)	10,200
Impact strength (ft. lbs. per notch in.) (Izad)	1.3
Modulus af elasticity (psi × 10^5)	3.5—4.0
Elangatian (%)	6—60
Shear strength (psi)	14,000

ELECTRICAL PROPERTIES

Volume resistivity (ahms cms)	10^{14}
Dielectric strength (volts per mil) shart time	422
stepwise	440
Dielectric constant (60 cycles)	3.61
Dielectric canstant (10^3 cycles)	3.6
Dielectric constant (10^6 cycles)	3.33
Pawer factar (60 cycles)	0.0070
Pawer factar (10^3 cycles)	0.0075
Pawer factar (10^6 cycles)	0.0365

OPTICAL PROPERTIES

Refractive index, N/D	1.486
Light transmission (%)	85—91
Calar range	Unlimited

THERMAL PROPERTIES

Thermal expansian (per °C × 10^{-5} below 50 °C)	7.8
Softening paint (°F)	140—160
Distartion under heat (°F)	115—140
Burning rate	Slow

STABILITY

Water absarptian (% after immersian 24 hrs.)	1—3
Effect af age	Outdaars—Yellows and embrittles
	Indaars or behind glass—Stable
Effect af sunlight	Very slight

FABRICATING DATA

Machining qualities	Good

EFFECT OF CHEMICALS

Saluble in esters, alcahals, ketanes, chlarinated hydracarbans; insaluble in aliphatic hydracarbons; stable in dilute alkalis; slawly decampased in dilute acids.

POLYVINYL CHLORIDES

TYPE: Thermaplastic.

GEON (B. F. Goodrich Chemical Co.)

OUTSTANDING QUALITIES: Taughness, excellent flame resistance, heat and abrasion resistance.

TYPICAL USES: Wire and cable jacketing material, chemically resistant gasket and tubing.

Available in granule and milled sheet.

GENERAL PROPERTIES — GRADE 1911

Specific gravity	1.33
Odar	None
Taste	None

MECHANICAL PROPERTIES

Tensile strength (psi)	2,400
Elongation (%)	300

ELECTRICAL PROPERTIES

Volume resistivity (ohms cms) (60°F)	Over 10^{13}
Dielectric strength (volts per mil)	800
Dielectric constant (60°F) (60 cycles)	5.50
Dielectric constant (60°F) (10^3 cycles)	4.50
Power factar (60°F) (60 cycles)	0.15
Power factor (60°F) (10^3 cycles)	0.13

OPTICAL PROPERTIES

Calar range	Black

THERMAL PROPERTIES — GRADE 1911

Top operating temperature (°F)	176
Burning rate (sq. in./sec.) 0.02 in. specimen	0
0.04 in. specimen	0

STABILITY

Tendency to cald flaw	Sligh
Water absorptian (% after immersian 24 hrs.)	
Weight gain plus saluble matter last	0.60
Soluble matter last	0.20
Effect af age	Very gradual stiffening; resists ozane completely
Effect of sunlight	Slaw darkening

FABRICATING AND MOLDING DATA

Malding qualities	Good
Malding methads	Campressian, Injectian, Transfer, Extrusion
Machining qualities	None
Effect an metal inserts	None

EFFECT OF CHEMICALS

Insoluble in acids, alkalies, alcahals, gasaline, all; saluble in ketanes same esters, resistant ta 10% sodium hydraxide, all acids and bases except glacial acetic, cancentrated sulfuric and hat cancentrated nitric acids.

OUTSTANDING QUALITIES: Electrical insulation, excellent mechanical properties, chemical resistance.

YPICAL USES: Wire and cable insulation, tubing, chemically resistant gaskets.

vailable in gronules and milled sheet.

NERAL PROPERTIES	GRADE 2042
pecific gravity	1.31
ulk factor	2.22
)dor	None
oste	None

CHANICAL PROPERTIES	
ensile strength (psi)	2,300
longotion (%)	330

CTRICAL PROPERTIES	
olume resistivity (ohms cms) (60 °F)	Over 10^{15}
)ielectric strength (volts per mil)	800
)ielectric constont (60°F) (60 cycles)	5.8
)ielectric constont (60°F) (10^3 cycles)	5.4
)ielectric constant (60°F) (10^6 cycles)	3.3
ower foctor (60°F) (60 cycles)	0.13
ower foctor (60°F) (10^3 cycles)	0.10
ower factor (60°F) (10^6 cycles)	0.10

TICAL PROPERTIES	
olor range	Black, Brown, Grey, Noturol

THERMAL PROPERTIES	GRADE 2042
Top operoting temperature (°F)	158
Burning rote (sq. in./sec.) 0.02 in. specimen	0.4
0.04 in. specimen	0

STABILITY	
Tendency to cold flow	Slight
Water absorption (% ofter immersion 24 hrs.)	
Weight gain plus soluble matter lost	0.50
Soluble motter lost	0.15
Effect of sunlight	Slow dorkening

FABRICATING AND MOLDING DATA	
Molding qualities	Good
Molding methods	Compression, Extrusion, Injection, Transfer
Machining qualities	None
Effect on metal inserts	None

EFFECT OF CHEMICALS

Insoluble in ocids, olkolies, olcohols, gosoline, oil; soluble in ketones, some esters; resistant to 10% sodium hydroxide, oil acids ond bases except glocial ocetic, concentroted sulfuric, hot concentrated nitric ocids.

UREA FORMALDEHYDES

TYPE: Thermosetting.

OUTSTANDING QUALITIES: Richness of color, translucent and opaque; solvent resistance; dielectric strength; tensile and flexural strength; low or no cold flow; lack of odor and taste.

TYPICAL USES: Housings, compacts, closures, light reflectors, high voltage and high frequency insulation, buttons, trays, hardware, toys and novelties, radio cabinets.

AKELITE UREA FORMALDEHYDE (Bakelite Corp.)

Avoilable In molding powder.

NERAL PROPERTIES	
Specific grovity	1.45—1.55
Groms per cu. In	23.9—25.5
Odor	None
Toste	None

CHANICAL PROPERTIES	
Tensile strength (psi)	9,500—12,000
Flexural strength (psi)	10,000—14,000
Impact strength (ft. lbs. per natch in.) (Izod) (milled notch In side)	0.28—0.34
Modulus of elasticity (psi × 10^5)	11—17

ERMAL PROPERTIES	
Top operating temperoture (°F)	180—200
Distortion under heat (°F)	212—240
Burning rote	Nane, chors ot 395° F

ELECTRICAL PROPERTIES	
Volume resistivity (ohms cms)	10^6—10^7
Dielectric strength (volts per mil) S/T 1/8"	300—350
Dielectric constant (60 cycles)	7.0—8.5
Dielectric constant (10^3 cycles)	6.4—9.0
Dielectric constant (10^6 cycles)	6.3—7.5
Power foctor (60 cycles)	0.035—0.10
Power foctor (10^3 cycles)	0.035—0.055
Power factor (10^6 cycles)	0.027—0.040

STABILITY	
Woter obsorption (% goin in wt. 24 hrs. immersion in woter ot room temp.)	0.60—1.20
Effect of oge	None

FABRICATING AND MOLDING DATA	
Molding qualities	Good
Molding methods	Compression
Machining quolities	Good

EFFECT OF CHEMICALS

Not offected by weok ocids or olkolies; decomposed by strong not affected by common solvents, greoses, oils or hydrocorbon solvents.

ETLE (American Cyanamid Company)

Available in molding powder and granulor form.

ENERAL PROPERTIES	
Specific grovity	1.45—1.50
Grams per cu. in	23.7—24.5
Odor	None
Toste	None

ECHANICAL PROPERTIES	
Tensile strength (psi)	5,500—7,000
Compressive strength (psi)	20,000—24,000
Flexural strength (psi)	11,000—18,000
Impact strength (ft. lbs. per notch in.) (Izod)	0.24—0.28
Rockwell hordness (M scale)	120

ABILITY	
Water obsorption (% ofter immersion 24 hrs. at 25° C)	1—3

ELECTRICAL PROPERTIES	
Dielectric strength (volts per mil)	300—350

OPTICAL PROPERTIES	
Color ronge	Unlimited (translucent white to black)

THERMAL PROPERTIES	
Top operating temperoture (°F)	170
Softening point (°F)	None
Distortion under heat (°F)	266—284
Burning rote	None (chors at 395° F)

FABRICATING AND MOLDING DATA	
Molding qualities	Good
Molding methods	Compression
Mochining quolities	Good

EFFECT OF CHEMICALS

Not offected by weak ocids or olkalies; decomposed by strong; not offected by common solvents, greoses, oils or hydrocarbon solvents.

PLASKON (Plaskon Div., Libbey-Owens-Ford)

Available in molding powder.

GENERAL PROPERTIES

Specific gravity	1.45—1.52
Grams per cu. in.	23.7—24.8
Odor	None
Taste	None

MECHANICAL PROPERTIES

Tensile strength (psi)	8,000—13,000
Compressive strength (psi)	25,000—35,000
Flexural strength (psi)	10,000—16,000
Impact strength (ft. lbs. per notch in.) (Izod)	0.24—0.35
Modulus of elasticity (psi × 10^5)	15.5—16.5
Brinell hardness	48—54

ELECTRICAL PROPERTIES

Volume resistivity (ohms cms)	10^{12}—10^{13}
Dielectric strength (volts per mil)	300—400
Dielectric constant (60 cycles)	7.0—7.4
Dielectric constant (10^6 cycles)	6.2—6.6
Power factor (60 cycles)	.039—.041
Power factor (10^6 cycles)	.029—.032
Arc resistance	180—186

OPTICAL PROPERTIES

Color range	Unlimited

THERMAL PROPERTIES

Thermal expansion (10^{-5} per °C)	1.7
Resistance to heat (continuous)	170° F
Top operating temperature (°F)	210
Burning rate	Non-flammable; chars at 395° F

STABILITY

Water absorption (% after immersion 24 hrs.)	0.5—0.7
Effect of age	None
Effect of sunlight	None

FABRICATING AND MOLDING DATA

Molding qualities	Good
Molding methods	Compression, Transfer
Machining qualities	Fair
Effect on metal inserts	None

EFFECT OF CHEMICALS

Not affected by weak acids or alkalies; decomposed by strong; not affected by common solvents, greases, oils or hydrocarbon solvents.

VINYL CHLORIDE-ACETATES

Elastomeric

TYPE: Thermoplastic.

OUTSTANDING QUALITIES: Molded—Flexibility; dimensional stability; dielectric strength; resistance to water, chemicals and abrasion; ease of moldability and fabrication. Sheeting—Also resistance to tearing and scuffing.

TYPICAL USES: Molded—Wire insulation, grommets, shoes, handbags, electrical parts, bumpers, cloth coatings. Sheeting—Raincoats, umbrellas, tobacco pouches, shoe tipping and foxing, irrigation bags for burns.

CHEMACO VINYL (Chemaco Corp.)

Available in molding powder.

GENERAL PROPERTIES

Specific gravity	1.30—1.50
Grams per cu. in.	21.2—24.5
Odor	Slight
Taste	None

MECHANICAL PROPERTIES

Tensile strength (psi)	8,000—10,000
Compressive strength (psi)	11,000
Impact strength (ft. lbs. per notch in.) (Izod)	0.2—1.4
Modulus of elasticity, (psi × 10^5)	3.5—4.1
Elongation (%)	200—250
Rockwell hardness	up to M75

ELECTRICAL PROPERTIES

Dry dielectric strength (on ⅜" O.D. extruded tubing, volts per mil)	700+
Wet dielectric strength (on ⅜" O.D. extruded tubing, volts per mil)	500+
Dielectric constant (60 cycles)	8.3—10.5
Dielectric constant (10^3 cycles)	5.0—6.0
Power factor (60 cycles)	0.048—0.500
Power factor (10^3 cycles)	0.08—0.12
Power factor (10^6 cycles)	0.10—0.16

OPTICAL PROPERTIES

Refractive index, N/D	1.544
Color range	Unlimited

THERMAL PROPERTIES

Thermal conductivity (10^{-4} cal. sec., cm. °C)	3.9—4.0
Specific heat (cal. per °C per gram)	0.32—0.51
Thermal expansion (per °C)	6.9
Top operating temperature (°F)	350
Softening point (°F)	140—200
Distortion under heat (°F)	170—250

Burning rate—will not support combustion, but if held in direct flame, rate less than 1" per 45 seconds.

STABILITY

Tendency to cold flow	Slight
Water absorption (% after immersion 24 hrs.)	0.1—0.15

Effect of age after exposure to 100° for 200 hrs. no cracking when bent around ⅛" mandrel.

Effect of sunlight	Slight

FABRICATING AND MOLDING DATA

Molding methods	Compression, Injection, Extrusion
Machining qualities	Fair
Effect on metal inserts	Inert

EFFECT OF CHEMICALS

Soluble in acetone; resistant to water, acids, alkali.

VINYLITE (Bakelite Corporation)

Available in molding compound, flexible sheet and sheeting.

	MOLDED GRADE VG-7734	FLEXIBLE SHEETING GRADE VU-1920
GENERAL PROPERTIES		
Specific gravity	1.38	1.27
MECHANICAL PROPERTIES		
Tensile strength (psi)	1,200	3,200
Elongation (%)	280	300
Stiffness (psi)	540	
Brittle temperature	—30°C	—25°C
Tear resistance (lb. per in.)	170	700
ELECTRICAL PROPERTIES		
Dielectric strength (volts per mil) short time	350	____
STABILITY		
Water absorption (0.075 in. specimen)		
Water absorbed (%)	0.90	0.11
Soluble matter lost (%)	0.20	0.03
THERMAL PROPERTIES		
Burning rate (sq. in./sec.)		
0.02 in. specimen	0.35	____
0.04 in. specimen	0.25	____
FABRICATING AND MOLDING DATA		
Molding methods	Compression, Extrusion, Injection	____
Machining qualities	____	Excellent

EFFECT OF CHEMICALS

Decomposed by strong oxidizing acids and alkalies; reacts slightly with some weak acids, strong reducing and organic acids; unaffected by alkalies, oxidizing agents, most inorganic acids, water, alcohol and aliphatic hydrocarbons.

Rigid

VINYLITE (Bakelite Corporation)

OUTSTANDING QUALITIES: Dimensional stability, tensile strength, dielectric strength, chemical and water resistance.
TYPICAL USES: Phonograph records, combs, toothbrush handles, architectural trim, cosmetic containers.
Available in molding compound.

GENERAL PROPERTIES	GRADE V-G 1800
Specific gravity	1.33
MECHANICAL PROPERTIES	
Tensile strength (psi)	8,600
Compressive strength (psi)	11,000
Flexural strength (psi)	13,700
Modulus of elasticity (psi)	430,000
Impact strength (ft. lb. per notch in.) (Izod)	0.3

THERMAL PROPERTIES	GRADE BG-1800
Distortion under heat (264 psi fiber stress)	55°C, 131°F
Burning rate	Self-extinguishing
STABILITY	
Water absorption (% total water absorbed)	0.1
MOLDING DATA	
Molding methods	Compression, Extrusion, Injection

EFFECT OF CHEMICALS

Decomposed by strong oxidizing acids and alkalies, reacts slightly with some weak acids, strong reducing and organic acids; unaffected by alkalies, oxidizing agents, most inorganic acids, water, alcohols, and aliphatic hydrocarbons.

VINYLIDENE CHLORIDE

TYPE: Thermoplastic.
OUTSTANDING QUALITIES: Tensile strength, high softening point, chemical inertness, resistance to water, non-flammability, toughness.
TYPICAL USES: (Molded)—chemical equipment, spray gun parts, containers, housings; plating masks, pump parts, name plates, bottles, plumbing parts and equipment. (Extruded)—tubing, pipe, screen, fabric.

SARAN (Dow Chemical Company)

Available in molding powder, pellets and film.

GENERAL PROPERTIES	
Specific gravity	1.65—1.72
Grams per cu. in.	27.18—28.53
Odor	Slight to none
MECHANICAL PROPERTIES	
Tensile strength (psi)	3,000—6,000*
Flexural strength (psi)	15,000—17,000
Impact strength (ft. lbs. per notch in.) (Izod)	0.3—1.0
Modulus of elasticity, (psi × 10^5)	0.7—2.0
Elongation (%)	10—40
Rockwell hardness	M50—M65
ELECTRICAL PROPERTIES	
Volume resistivity (ohms cms)	10^{14}—10^{15}
Dielectric strength (volts per mil)	Short time—400; stepwise—350
Dielectric constant (60 cycles)	3—5
Dielectric constant (10^3 cycles)	3—5
Dielectric constant (10^6 cycles)	3—5
Power factor (60 cycles)	0.03—0.045
Power factor (10^3 cycles)	0.03—0.15
Power factor (10^6 cycles)	0.045—0.065
OPTICAL PROPERTIES	
Refractive index, N/D	1.60—1.63
Color range	Limited

THERMAL PROPERTIES	
Thermal conductivity (cal/cm^2/°C/cm/sec. × 10^{-4})	3.0
Specific heat (cal. per °C per gram)	0.32
Thermal expansion (10^{-5}/°C)	19
Softening point (°F)	240—280
Distortion under heat (°F)	150—180
Burning rate	Non-flammable
STABILITY	
Water absorption (% after immersion 24 hrs.)	Less than 0.1
Effect of age	Resistance, Excellent
Effect of sunlight	Darkens Slightly
FABRICATING AND MOLDING DATA	
Molding qualities	Excellent
Molding methods	Injection, Extrusion, Compression
Machining qualities	Good
Effect on metal inserts	Inert

EFFECT OF CHEMICALS

Resistant to 10.20 and 60% sulfuric acid, 10% nitric acid, 10 and 35% hydrochloric acid, 10% and glacial acetic acid, oleic acid, ethyl alcohol, turpentine, 10% sodium hydroxide, carbon tetrachloride; decomposed by chlorine water, ethylene dichloride, 10 and 28% ammonia.
Resistant to most organic and mineral acids, concentrated or dilute, alkalies, organic solvents; decomposed by ammonia, chlorine, ethylene dichloride.

*On highly oriented extruded sections, such as cordage, tensile strength up to 40,000 psi is obtainable.

MOLDING BLANKS

TYPE: Thermosetting. Maximum strength is gained with the grain and with minimum flow.

BAKELITE MOLDING BOARDS AND BLANKS (Bakelite Corporation)

OUTSTANDING QUALITIES: Impact and flexural strength.
TYPICAL USES: Valve handles, radio sockets, practice bayonets, switch parts, electrical coils.

Available in board and blank.

Specific gravity	1.38
Grams per cu. in.	22.6
Tensile strength (psi)	3,000—11,000
Flexural strength (psi)	13,000—25,000
Impact strength (ft. lbs. per notch in.) with grain	10.0—12.5
cross grain	3.7—5.6
Modulus of elasticity (psi)	1.1—1.6 × 10^6
Dielectric strength (volts per mil) (at 60 cycles) (instantaneous or short time)	240
Top operating temperature (°F)	302
Water absorption (gain after immersion 24 hrs.)	0.5%—6.0%
Molding methods	Compression

CO-RO-LITE (Columbian Rope Company) [Molding Blanks] Cont

OUTSTANDING QUALITIES: High impact strength and heat distortian temperature; capacity for complex shapes.

TYPICAL USES: Helmet liner, gasoline tank, babbin head, tray, angles, irregular channels, ammunitian box, fairings.

Available in molding blank.

GENERAL PROPERTIES

Specific gravity	0.8—1.35

MECHANICAL PROPERTIES

Tensile strength (psi)	10,000
Compressive strength (psi)	35,000
Flexural strength (psi)	18,000
Impact strength (ft. lbs. per notch in.) (Charpy)	4
Modulus of elasticity (psi × 10^5)	11
Shear strength (psi) flatwise	20,000
edgewise	6,000

ELECTRICAL PROPERTIES

Volume resistivity (ohms cms)	10^{11}—10^{12}
Dielectric strength (volts per mil)	365
Dielectric constant (60 cycles)	7.5
Dielectric constant (10^6 cycles)	4.6
Power factor (60 cycles)	0.21
Power factor (10^6 cycles)	0.04

OPTICAL PROPERTIES

Color range	Dark Shades

Note: Co-Ro-lite may also be impregnated with the ureas, melamines and thermoplastic resins.

THERMAL PROPERTIES

Thermal conductivity (10^{-4} cal. sec., cm. °C)	2—
Specific heat (cal. per °C per gram)	0.3—0.
Thermal expansion (per °C × 10^{-5})	7—2
Softening point (°F)	None
Distortion under heat (°F)	32
Burning rate	Very Slo

STABILITY

Tendency to cold flow	None under safe working loa
Water absorption (% after immersion 24 hrs.)	1.5 Maximum
Effect of age	Improves mechanical, electrical properties
Effect of sunlight	Lowers surface resistance

FABRICATING AND MOLDING DATA

Molding methods	Low Pressure, Compression, Transfe
Effect on metal inserts	None
Bulk factor	6

EFFECT OF CHEMICALS

Decomposed by strong oxidizing acids and strong alkalies; not affected by reducing or organic acids or organic solvents, except hot phenol resistant to water, aqueous solutions and steam.

RESIN FIBRES

KYS-ITE (Keyes Fibre Company)

OUTSTANDING QUALITIES: Impact and flexural strength, low cost.

TYPICAL USES: Office machine and ather housings; trays; electrical equipment; hand wheels.

Available in finished products.

GENERAL PROPERTIES

Specific gravity	1.39—1.45
Grams per cu. in.	22.7—23.7
Odor	None
Taste	None

MECHANICAL PROPERTIES

Tensile strength (psi)	4,500—11,000
Compressive strength (psi)	22,800—35,200
Flexural strength (psi)	12,000—18,000
Impact strength (ft. lbs. per notch in.) (Izod) flatwise	1.76—4.4
edgewise	0.87—1.30

OPTICAL PROPERTIES

Light transmission (%)	Opaque
Color range	Medium to Dark Shades

STABILITY

Water absorption (% after immersion 24 hrs.)	0.50—2.20
Effect of boiling in water 24 hrs.	None to Slight Surface Raughing
Effect of age	None
Effect of prolonged sunlight	Surface Discoloration

FABRICATING AND MOLDING DATA

Molding methods	Compression and Transfer
Machining qualities	Good
Effect on metal inserts	Inert

EFFECT OF CHEMICALS

Decomposed by strong oxidizing acids and strong alkalies; slightly or not affected by weak acids, weak alkalies, and is not affected by oils and gasoline, ethyl alcohol, ethyl ether, acetone, xylol, carbon tetrachloride, pyridine.

RESIN FIBRES (Hawley Products Company)

OUTSTANDING QUALITIES: Strength, lowered pressure requirement, comparatively low cast.

TYPICAL USES: Refrigerator panels, radio cabinets, warld glabes, diaphragms for laud speakers, etc. Indicated uses—For parts with compound curves.

Available in pre-forms and finished products.

GENERAL PROPERTIES

Specific gravity	1.33—1.35

FABRICATING AND MOLDING DATA

Molding qualities	Good
Molding methods	Compression, Low Pressure, Contact Pressure

Note: Phenolic resins have been used hitherta; the use of melamine resins is also indicated.

MECHANICAL PROPERTIES

Tensile strength (psi)	15,000—20,000
Compressive strength (psi) edgewise	23,000—28,000
Flexural strength (psi)	16,000—23,000
Impact strength (ft. lbs. per notch in.) (Izod)	3.0—4.0

STABILITY

Water absorption (% after immersion 24 hrs.)	0.8—1.0

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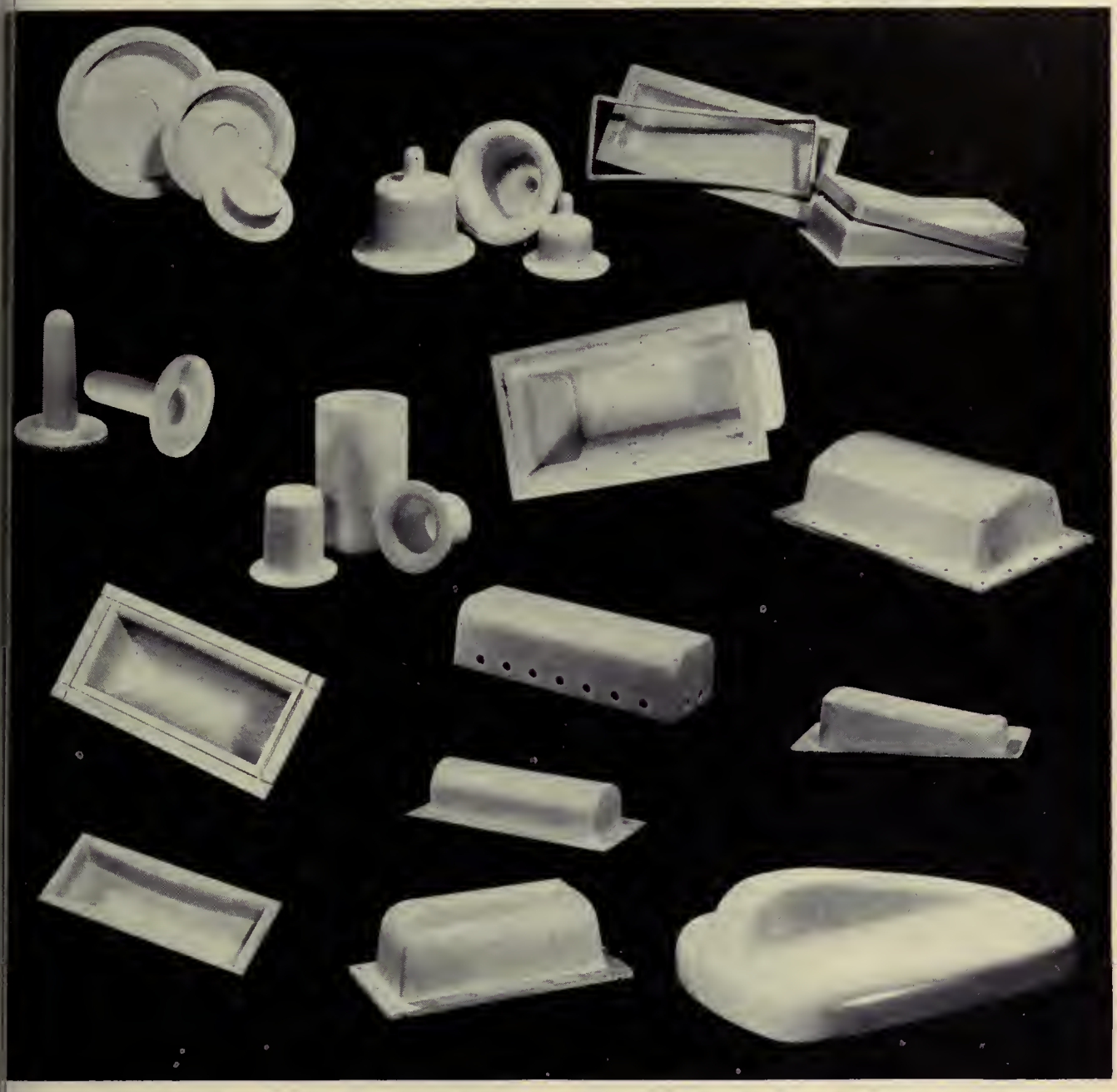

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Buyers Guide of Plastics Products

The products listed in the following pages are those of the various manufacturers in the industry—the molders, laminators, fabricators, coaters, impregnators, etc. This list is intended to serve as a buyers' source guide to the manufacturers who produce the thousands of plastics items now used commercially. Addresses for these manufacturers, and other information, are in the Directory Section, beginning on page 221.

Adding machine keys, parts
Emeloid Co., The (N.J.)
Magnetic Plastics Co. (O.)
National Plastics, Inc. (Tenn.)

Advertising displays, novelties, signs
Acrylite Products Inc. (N.Y.)
Artcraft Plastics Corp. (N.Y.)
Cincinnati Advertising Products Co. (Ohio)
Empress Novelty Company (N.Y.)
Dura Plastics Inc. (N.Y.)
Kuteh, Walter E. Co. (Mich.)
Long Island Engraving Co. (N.Y.)
Lustra-Cite Industries (N.Y.)
McDowell Plastic Company (Ill.)
Mildern Mfg. Co. (N.Y.)
Minnesota Plastics Corp. (Minn.)
Newport, J. Herbert Jr. (Pa.)
Plastie Die & Tool Corp. (Calif.)
Plastie Projects (N.Y.)
Plastics Fabricators Co. (Calif.)
R. & C. Plastic Products (R.I.)
Rothco Products (Pa.)
Sward, H. A. Co. (N.Y.)
Virginia Plak Co. (N.Y.)

Aircraft cockpits
Heath Company (Mich.)

Aircraft parts, accessories
Allied Aviation Corporation (Md.)
Atlas Moulded Products Corp (N.Y.)
Chrysler Corporation (Mich.)
Clover Box & Mfg. Co., Inc. (N.Y.)
Enka Plastie Company (Calif.)
General Plastics Co. (Calif.)
Industrial Plastics Corp. (Calif.)
Mildern Mfg. Co. (N.Y.)
Mycalex Corp. of America (Ill.)
Na-Mac Products Corp. (Calif.)
RPM Company, The (Colo.)
Wills & Roberts Plastics Mfg. Corp. (California)

Aircraft pontoons
Heath Company (Mich.)

Aircraft windows
Clover Box & Mfg. Co., Inc. (N.Y.)

Albums
Kingsbacher-Murphy Co. (Calif.)
Kirk, F. J. Molding Co. (Mass.)

Aprons
Art Textile Decorating Co. (N.Y.)
Buchsbaum, S. & Co. (Ill.)
Fabricated Products Co. (Ill.)
Lamotex Corp. (N.Y.)
Rand Rubber Company (N.Y.)
White Products Co. (N.Y.)

Artificial eyes
Gits Molding Corp. (Ill.)
Monoplex Eye (Mass.)
Obrig Laboratories, Inc. (N.Y.)

Archery items
Plastal Specialties Co. (Wash.)

Ash trays
Accurate Molding Corp. (N.Y.)
Beaman Molded Products Co. (Ore.)
Davies, Harry Molding Co. (Ill.)
Emeloid Co., The (N.J.)
Maple Leaf Plastics Ltd. (Ontario, Canada)
Nichols Plastic & Engineering Co. (California)
Reinhold, F. E. Mfr. (Calif.)
Seder & Son Molded Products Co. (Colorado)
Wayne Plastic Products (Ind.)

Atomizers & parts
Kilgore Mfg. Co. (Ohio)
Plastal Specialties Co. (Wash.)

Automotive parts, accessories
Chrysler Corporation (Mich.)
Clover Box & Mfg. Co., Inc. (N.Y.)
Gemloid Corporation (N.Y.)
General Plastics Co. (Calif.)
General Products Corp. (N.Y.)
Hoosick Engineering Co. (N.Y.)
Mildern Mfg. Co. (N.Y.)
Tungsten Contact Mfg. Co., Inc. (New Jersey)
Voges Mfg. Co. (N.Y.)

Badges
American Emblem Co. (N.Y.)
Cellulose Products Co. (Calif.)

[BADGES] Cont.
Dawson Company (Ohio)
Lifetime Plastic, Inc. (Colo.)
Plastie Laminating Co. (Calif.)
Whitehead & Hoag Co. (N.J.)
Willson Magazine Camera Co. (Pa.)

Bags
Central Envelope Co. (N.Y.)
Classic Studio (N.Y.)
National Transparent Mfg. Co. (New York)
Prepac (N.Y.)

Bags, blanket
Fabricated Products Co. (Ill.)

Bags, garbage disposal
General Plastic Products (Mich.)

Bags, knitting
Newell, J. O. Industries (Ont., Can.)

Bags, shirt
White Products Co. (N.Y.)

Bags, wardrobe
Fabricated Products Co. (Ill.)

Balls
Gits Molding Corp. (Ill.)
Levien, Ned G. Inc. (N.Y.)
National Fabricating Co. (N.Y.)
Nichols Plastic & Engineering Co. (California)
Synthetic Plastics Sales Co. (N.Y.)
Plastics Service Co. (Wis.)
Recto Molded Products, Inc.
Waterbury Companies, Inc. (Conn.)

Banks
Ardee Plastics Co., Inc. (N.Y.)
Electroforming Company (Wis.)
Gits Molding Corp. (Ill.)
Plasti-Mode Novelty Co. (N.Y.)

Barrettes
Dominion Comb & Novelty Co. (Quebec, Canada)
Granby Mfg. Co. (Que., Can.)
Kingman, E. B. Co. (Mass.)
Tilton & Cook Co. (Mass.)

Bars, accessories
Algerley Laboratories (Pa.)
Sward, H. A. Co. (N.Y.)

Bath tubs
Commonwealth Products Co. (Pa.)

Bathroom fixtures, accessories
American Plastic Mfg. Co. (Ill.)
Clover Box & Mfg. Co., Inc. (N.Y.)
Columbus Plastic Products, Inc. (Ohio)
Duranol Products Inc. (N.Y.)
General Plastic Products (Mich.)
Majestie Plastic Co., Inc. (Fla.)
Mildern Mfg. Co. (N.Y.)
Multi-Plex Mfg. Co. (Calif.)
Plano Molding Co. (Ill.)
Plasticrest Products (Ill.)
Practical Plastics, Inc. (Fla.)
Schillo Manufacturing Co. (Ill.)
Tech-Craft Plastics, Inc. (Wash.)
Vine-Ite Plastics Co. (Colo.)

Beads
Mastercraft Plastics Co., Inc. (N.Y.)
Plastic Process Co. (Calif.)
Synthetic Plastics Sales Co. (N.Y.)

Bearings
American Brakeblok Div. (Mich.)
Gatke Corporation (Ill.)
Ryerson, Joseph T. & Son, Inc. (Ill.)

Belts, belting
Buchsbaum, S. & Co. (Ill.)
Die-Plast Co. Ltd. (Que., Can.)
Gemloid Corporation (N.Y.)
Irvington Varnish & Insulator Co. (New Jersey)
Sterling Injection Molding, Inc. (New York)

Beverage containers
Gerber Plastic Co. (Mo.)

Bicycle parts
Ohio Plastic Co., The (Ohio)

Billfolds
Buchsbaum, S. & Co. (Ill.)
General Plastie Products (Mich.)

Binder screws, posts
Griffin, Campbell, Hayes, Walsh, Inc. (New York)

[BINDER SCREWS] Cont.
Kirk, F. J. Molding Co. (Mass.)
National Plastics, Inc. (Tenn.)
Spector, Robert (N.Y.)

Binding
General Binding Corp. (Ill.)

Binoculars
Watertown Mfg. Co. (Conn.)

Bird baths
Sewell Mfg. Co. (Mich.)

Blueprint covers
Risch, H. Celluloid Products (N.Y.)

Blueprints
Dawson Company (Ohio)
National Plastic Co. (Calif.)

Boat parts
Allied Aviation Corporation (Md.)
Mildern Mfg. Co. (N.Y.)

Boats
California Plastics Products Corp. (California)
Chrysler Corporation (Mich.)
Duramold Div., Fairchild Engine (New York)
Enka Plastic Company (Calif.)
Western Plastics, Inc. (Calif.)
Wills & Roberts Plastics Mfg. Corp. (California)
Winner Mfg. Co., Inc. (N.J.)

Bobbins
Breyer Molding Co. (Ill.)
Illini Molded Plastics (Ill.)
Victory Mfg. Co. (Ill.)

Bodkins
Plastic Die & Tool Corp. (Calif.)

Book binding, hinges
Plastic Binding Corp. (Ill.)
Plastic Process Co. (Calif.)
Tauber Plastics, Inc. (N.Y.)

Book ends
Almac Plastics, Inc. (N.Y.)
Customcraft Plastic Co. (N.Y.)
Dorian Studio (Calif.)
Majestic Plastic Co., Inc. (Fla.)
New Onyx Plastic & Novelty Co. (New York)
Plasticraft Specialties (Ill.)
Straus & Stingo, Inc. (N.Y.)
Technical Plastics Co. (Ohio)

Bottle caps
Grigoleit Company, The (Ill.)
Kampa Mfg. Co. (Wis.)
Sillcocks-Miller Co., The (N.J.)
Warren Plastics Corp. (Pa.)

Bottle cap liners
Irvington Varnish & Insulator Co. (New Jersey)

Bottlas
Celluplastic Corporation (N.J.)
Colt's Patent Fire Arms Mfg. Co. (Connecticut)

Bowles
Almac Plastics, Inc. (N.Y.)
Ardee Plastics Co. Inc., (N.Y.)
Die-Plast Co. Ltd. (Que., Can.)
Dorian Studio (Calif.)
Gem Plastics Co. (Calif.)
Kilgore Mfg. Co., The (Ohio)
Na-Mac Products Corp. (Calif.)
Technical Plastics Co. (Ohio)

Boxes
Acme Folding Box Co., Inc. (N.Y.)
Almac Plastics, Inc. (N.Y.)
Arvey Corporation (Ill.)
Belmont Plastics Co. (Cal.)
Clover Box & Mfg. Co., Inc. (N.Y.)
Fibreboard Products, Inc. (Calif.)
Hunton Plastics Co. (N.J.)
Hyproducts Corporation (N.Y.)
Lebanon Paper Box Co., (Pa.)
Multi-Plex Mfg. Co. (Calif.)
National Bronze Studios (Calif.)
New England Box Co., The (Mass.)
Northwest Plastics, Inc. (Minn.)
Nusshaum, F. J. & Co. (N.Y.)
Plastics Service Co. (Calif.)
Premier Engineering Supplies, Ltd. (Ontario, Canada)
Presque Isle Plastics, Inc. (Pa.)
Robertson Paper Box Co., Inc. (Connecticut)

[BOXES] Cont.
Shoe Form Company, Inc. (N.Y.)
Somerville Limited (Ont., Can.)
Southern Plastics Co. (S.C.)
Standard Molding Corp. (Ohio)
Sward, H. A. Co. (N.Y.)
Synthetic Plastics Sales Co. (N.Y.)
United Paperboard Co., Inc. (N.Y.)
Victory Mfg. Co. (Ill.)
Vlchek Tool Co., The (Ohio)
Wynn Mfg. Co. (Pa.)

Brackets (shalf, wall)
Almac Plastics, Inc. (N.Y.)
Plastic Process Co. (Calif.)
Plasticrest Products (Ill.)
Southern California Plastic Co. (California)

Braid
Hall Line Corp. (N.Y.)
Printon Corporation (N.Y.)

Brush backs, handles, parts
Classic Studio (N.Y.)
Clover Box & Mfg. Co., Inc. (N.Y.)
Gemloid Corporation (N.Y.)
Mark Novelty Corp. (N.Y.)
Mastercraft Plastics Co., Inc. (N.Y.)
Plasticraft Mfg. Co. (N.J.)

Brushes
Astor-Ramel Mfg. Co. (N.Y.)
Cellulose Industries Co. (N.Y.)
Cclomat Corporation (N.Y.)
Clarolyte Company (N.Y.)
Kippy Kit Co., (Ohio)
Prolon Plastics, Div. of Pro-Phy-Tic Brush Co. (Massachuetts
Metaltex, Inc. (N.Y.)
Wecolite Company (N.Y.)

Buckles
Camp Plastics Corp. (N.J.)
Central Plastics, Inc. (N.Y.)
Mitchell Button Co., Ltd. The (Ontario, Canada)
Timely Novelty Co. (N.Y.)

Building supplies
Casements Window Glaze Co. (N.Y.)
Wills & Roberts Plastics Mfg. Corp. (California)

Bushings
Mildren Mfg. Co. (N.Y.)
Zippy Corporation (Wash.)

Buttons
Ardor of Paris (N.Y.)
Art Pearl Works (N.J.)
Automatic Button Co. (Iowa)
Axel Plastic Button Company (N.Y.)
Ben-Art Novelty Co., Inc. (N.Y.)
Button Corp. of America (N.J.)
Celoid Mfg. Company (N.Y.)
Central Plastics, Inc. (N.Y.)
Dominion Button Manufacturers, Ltd. (Ontario, Canada)
Drell Novelty Mfg. Co., The (N.Y.)
Emsig Manufacturing Co. (N.Y.)
Gleich, Emanuel D. (N.Y.)
Greene Plastics (R.I.)
Hoffman Mfg. Co. (N.Y.)
Kenilworth Plastics Molding Co. (div. Eureka Button Co.) (New Jersey)
Lindenhurst Mfg. Co., Inc. (N.Y.)
Mitchell Button Co., Ltd. The (Ontario, Canada)
National Fabricating Co. (N.Y.)
Plastics Projects (N.Y.)
Superior Plastics Corp. (N.Y.)
Supreme Plastic Mfg. Co. (N.Y.)
Synthetic Plastics Co. (N.J.)
Synthetic Plastics Sales Co. (N.Y.)
Victory Button Co., Inc. (Mass.)
Voges Manufacturing Co. (N.Y.)

Cabinets
Calplasti Corporation (Calif.)
McDonald Manufacturing Co. (Cal.)
Mildern Mfg. Co. (N.Y.)

Calculators
Carroll, J. B. Co. (Ill.)
Emeloid Co., The (N.J.)
Felsenthal, G. & Sons (Ill.)
Hopp Press, The Inc.
Virginia Plak Co. (N.Y.)

Calendars
ic Plastics, Inc. (N.Y.)
raft Plastics Corp. (N.Y.)
klin Industrial Engineering
ennsylvania)

Candle holders
ac Plastics, Inc. (N.Y.)
mann Bros. Inc. (Pa.)
ornia Giftware (Cal.)
omcraft Plastic Co. (N.Y.)
an Studio (Cal.)
s & Stingo, Inc. (N.Y.)
elsen Machine Co. (Mass.)

Candles
ner Company, The (O.)

Candy boxes
sic Studio (N.Y.)
se of Plastics (O.)
ton Plastics Co. (N.J.)
ision Specialties (Calif.)
ton Brothers (Ill.)
nical Plastics Co. (Ohio)

Candy dishes
ac Plastics, Inc. (N.Y.)
om craft Plastic Co. (N.Y.)
ory Mfg. Co. (Ill.)

Cannisters
er Plastic Co. (Mo.)
ek Tool Co., The (Ohio)

Caps, closures
. & K. Company (N.Y.)
rican Flange & Mfg. Co., Inc.
strong Cork Company (Pa.)
llac Plastic Co. (Mich.)
loid Corporation (N.Y.)
tic Engineering, Inc. (Ohio)
r & Son Molded Products Co.
Colorado)
ocks-Miller Co., The (N.J.)
cialty Insulation Mfg. Co., Inc.
New York)
kelsen Machine Co. (Mass.)
or Metal Products Corp. (N.Y.)
eling Stamping Co. (W.Va.)
te, S. S. Dental Mfg. Co., The
New York)
z, A. H., Inc. (Pa.)

Card boxes
ac Plastics, Inc. (N.Y.)
nton Plastics Co. (N.J.)

Card cases
ver Box & Mfg. Co., Inc. (N.Y.)
eloid Co., The (N.J.)
ch, H. Celluloid Products (N.Y.)
rgish & Company (N.Y.)

Card holders
ulosc Products Company (Cal.)
ver Box & Mfg. Co., Inc. (N.Y.)
eloid Co., The (N.J.)
press Novelty Company (N.Y.)
gsbacher-Murphy Co. (Calif.)
ional Plastic Co. (Calif.)
stic Fabricators Co. (Calif.)
stics Service Co. (Calif.)
stern Plastics Ltd. (B. C., Can.)
py Corporation (Wash.)

Cards
ver Manufacturing Co. (Ill.)
vson Company (Ohio)
loid Co., The (N.J.)
ional Transparent Plastics Co.
Massachusetts)

Centerpieces
ger, Joseph E. (Pa.)

Chairs
ional Research & Mfg. Co. (Cal.)
ner Mfg. Co., Inc. (N.J.)

Charts
eloid Co., The (N.J.)
g Island Engraving Co. (N.Y.)
mochart Co., The (Penna.)

Checkers
yer Molding Co. (Ill.)
s Molding Corp. (Ill.)
we, E. S. Co., Inc. (N.Y.)
ckton, E. M. (Ill.)
nthetic Plastics Sales Co. (N.Y.)

Chess
s Molding Corp. (Ill.)
we, E. S. Co., Inc. (N.Y.)

Cigarette boxes, cases
gerley Laboratories (Pa.)
mac Plastics, Inc. (N.Y.)
lmont Plastics Co. (Cal.)
ss Plasticrafters (Mich.)
assic Studio (N.Y.)
lifornia Giftware (Calif.)
ver Box & Mfg. Co., Inc. (N.Y.)
stomcraft Plastic Co. (N.Y.)
rian Studio (Cal.)
nklin Industrial Engineering
(Pennsylvania)
m Plastic Co. (N.Y.)
buse of Plastics (Ohio)
unton Plastics Co. (N.J.)
astic Projects (N.Y.)
astic Wood Crafts (Ohio)
asti-Mode Novelty Co. (N.Y.)
perior Plastics Corp. (N.Y.)
raus & Stingo, Inc. (N.Y.)
argish & Company (N.Y.)

Cigarette cases
Almac Plastics, Inc. (N.Y.)
Amos Molded Plastics (Ind.)
Artcraft Plastics Corp. (N.Y.)
Cal-Pacific Co. (Calif.)
Clover Box & Mfg. Co., Inc. (N.Y.)
Crafts, Inc. (R.I.)
Dandy Plastic Products Co., Inc.
(New York)
Gemloid Corporation (N.Y.)
General Plastic Products (Mich.)
Herman, J. B. Co. (Mass.)
Hoffman Mfg. Co. (N.Y.)
Mavco Sales Inc. (N.Y.)
Nussbaum, F. J. & Co. (N.Y.)
Plas-Tex Corp., The (Calif.)
Plasticraft Specialties (Ill.)
Plastic Die & Tool Corp. (Calif.)
Plastic Specialties (Calif.)
Precision Specialties (Calif.)
Statler Manufacturing Co. (Ill.)
T-Die Cast & Molded Products
(California)
Vargish & Company (N.Y.)
Western Plastics Ltd. (B. C., Can.)

Cigarette dispensers
Sherr Manufacturing Co. (Cal.)
Vargish & Company (N.Y.)

Cigarette, cigar holders
Gemloid Corporation (N.Y.)
National Plastics, Inc. (Tenn.)
Neo Plastics Products Co. (N.Y.)
Perlman, A., Plastics, Inc. (N.Y.)

Cigarette lighters
Almac Plastics, Inc. (N.Y.)
Modglin Co. (Calif.)
Plastolite Co., The (Pa.)
Victory Aircraft Corp. & Interna-
tional Plastics (California)

Cleaners
Downy Products Company (N.J.)
Gem Shine Products Co. (Ill.)
Penetone Company, The (N.J.)
Pennsylvania Salt Mfg. Co. (Pa.)
Pierce & Stevens, Inc. (N.Y.)
Schwartz Chemical Co. (N.Y.)

Clock cases
Galbas, Ferdinand F. (N.Y.)
Mildern Mfg. Co. (N.Y.)
Plasti-Mode Novelty Co. (N.Y.)

Clocks
Lackner Company, The (Ohio)

Closet accessories
Duranol Products Inc. (N.Y.)
Schneider, Eugene S. (Cal.)

Clothes sprinklers
Plas-Tex Corp., The (Calif.)
Victory Mfg. Co. (Ill.)

Clothes line reels
Columbus Plastic Products, Inc.
(Ohio)

Clothespins
Columbus Plastic Products, Inc. (O.)
Drake-Clute Mfg. Co. (N.J.)
Hntzler Mfg. Co. (N.Y.)
Lee-Bert, Inc. (Mich.)
Modglin Co. (Calif.)
Rezolin Co., The (Calif.)
Vermont Plastics Inc. (Vt.)

Coasters
Algerley Laboratories (Pa.)
Eastern Plastics, Inc. (Pa.)
Franklin Industrial Engineering
(Pennsylvania)
Hunton Plastics Co. (N.J.)
Mildern Mfg. Co. (N.Y.)
Sward, H. A. Co. (N.Y.)
Technical Plastics Co. (Ohio)
Vargish & Company (N.Y.)
Wayne Plastic Products (Ind.)

Coatings (incl. insulation, lacquers)
Advance Solvents & Chemical Corp.
(New York)
Amercoat Division, American Pipe
and Construction Co. (California)
American Resinous Chemicals Corp.
(Massachusetts)
Bach, Leo (N.Y.)
Baker Synethtics, Inc. (N.Y.)
Beutex Corporation, The (N.J.)
Cello-Plastic Chemical Co. (Pa.)
Chamberlain Engineering Corp.
(Ohio)
Cineline Company (Ind.)
Cleaveland Laboratory & Mfg. Co.,
Inc. (New Jersey)
Eronel Services, Inc. (Calif.)
General Plastics Mfg. Co. (Wash.)
Goodrich, B. F. Co., The (Ohio)
Goodall-Sanford Inc. (Me.), Reading
Division
Greggory Inc. (Ill.)
Hercules Powder Company (Del.)
Heribert, Herbert J. (N.Y.)
Industrial Design Associates of
Hollywood (California)
Lifetime Plastic Inc. (Colo.)
National Paint Products Inc. (N.J.)
Naugatuck Chemical (N.Y.), Div.
United States Rubber Co.

[COATINGS] Cont.
Pierce & Stevens, Inc. (N.Y.)
Plastex Adhesive Products, Inc.
(New York)
Plastics Film Corp. (N.Y.)
Plastite Adhesive Cement Co. (Ill.)
Poly Resins (Calif.)
Price, M. B. Associates (N.Y.)
Rogers Chemical Co. (Mich.)
Roxalin Flexible Finishes Inc.
(New Jersey)
Service Industries (Pa.)
Sherwin-Williams Co. (Ohio)
Spartan Industrial Corp.
Speed-o-Laq Products Co. (Minn.)
Synthetic Resins Ltd. (Ont., Can.)
Testworth Laboratories, Inc. (Ill.)
Textileather Corp. (Ohio)
Udylite Corporation, The (Mich.)
United Chromium, Inc. (N.Y.)
United States Stoneware Co. (Ohio)
Wills & Roberts Plastics Mfg. Corp.
(California)
Zapon Division (Conn.) Atlas Pow-
der Co.
Zapon-Keratol Div. (Conn.) Atlas
Powder Co.

Coatings, strip
Better Finishes & Coatings, Inc.
(New Jersey)
Seal-Peel Inc. (Mich.)

Coil forms
Emeloid Co., The (N.J.)
Keller Products (N.H.)
Mildern Mfg. Co. (N.Y.)
Illini Molded Plastics (Ill.)
Plano Molding Co. (Ill.)
Victory Mfg. Co. (Ill.)

Coils
Schwab & Frank, Inc. (Mich.)
Southern Plastics Co. (S.C.)

Coin slots
Carlson, G. O. Co. (Conn.)
Gits Molding Corp. (Ill.)
Mills, Elmer E. Co. (Ill.)
Hyde, A. L. Co. (N.J.)

Collar stays
Celoid Mfg. Company (N.Y.)

Combs
All Metal Screw Product (N.Y.)
Astor-Ramel Mfg. Co. (N.Y.)
Bolta Company, The (Mass.)
Cameo Novelty Co. (N.Y.)
Cellulose Industries Co. (N.Y.)
Celomat Corporation (N.Y.)
Clinford Corp. (N.J.)
Columbia Protektosite Co., Inc.
(New Jersey)
Dandy Plastic Products Co., Inc.
(New York)
Diadem, Inc. (Mass.)
Dominion Comb & Novelty Co.
(Quebec, Canada)
Foster Grant Co., Inc. (Mass.)
Gemloid Corporation (N.Y.)
Kingman, E. B. Co. (Mass.) (div.
Ben Hur Products, Inc.)
Kirk, F. J. Molding Co. (Mass.)
Modglin Co. (Calif.)
Plas-Tex Corp., The (Calif.)
Plastic Jewel Co. (N.Y.)
Plasticraft Mfg. Co. (N.J.)
Prolon Plastics Div. of Pro-Phy-Lac-
Tic Brush Co. (Massachusetts)
Stanton Brothers (Ill.)
Statler Manufacturing Co. (Ill.)
Sterling Plastics Co. (N.J.)
Tilton & Cook Co. (Mass.)
United Plastic Co. (Mass.)
Victory Button Co., Inc. (Mass.)
Voges Manufacturing Co. (N.Y.)
Whyte Mfg. Co., Inc. (N.Y.)

Compacts
Artcraft Plastics Corp. (N.Y.)
Bel-Air Creations (Calif.)
Belmont Plastics Co. (Calif.)
Crafts, Inc. (R.I.)
Customcraft Plastic Co. (N.Y.)
Dandy Plastic Products Co., Inc.
(New York)
Elzac (Calif.)
Die-Plast Co. Ltd. (Que., Can.)
Emeloid Co., The (N.J.)
Gemloid Corporation (N.Y.)
Gem Plastic Co. (N.Y.)
Herman, J. B. Co. (Mass.)
Hoffman Mfg. Co. (N.Y.)
Irwin Engineering & Mfg. Co.
(California)
Kampa Mfg. Co. (Wis.)
Mavco Sales Inc. (N.Y.)
Miracle Plastic Mfg. Co. (N.Y.)
Molnar, John E. (Mo.)
National Fabricating Co. (N.Y.)
Neo Plastics Products Co. (N.Y.)
Norton Laboratories, Inc. (N.Y.)
Nussbaum, F. J. & Co. (N.Y.)
Plas-Tex Corp., The (Calif.)
Plastic Specialties (Calif.)
Plastifab, Inc. (Ill.)
Precision Specialties (Calif.)
T-Die Cast & Molded Products
(California)
Technical Plastics Co. (Ohio)

[COMPACTS] Cont.
Victory Aircraft Corp. & Interna-
tional Plastics (California)

Computers
Emeloid Co., The (N.J.)
Felsenthal, G. & Sons (Ill.)
Sillcocks-Miller Co., The (N.J.)
Stanley Mfg. Co. Ltd. (Ont., Can.)

Containers
Atlas Moulded Products Corp (N.Y.)
Cambridge Paper Box Co. (Mass.)
Celluplastic Corporation (N.J.)
Central States Paper & Bag Co.
(Missouri)
Clover Box & Mfg.Co., Inc. (N.Y.)
Dawson Company (Ohio)
Gair, Robert Co., Inc. (N.Y.)
Gaylord Container Corp. (Mo.)
Imperial Molded Products Corp.
(Illinois)
Lusteroid Container Co., Inc. (N.J.)
Metropolitan Plastic Products Co.
(New York)
Miro Container Co., Inc. (N.Y.)
National Plastic Co. (Calif.)
National Transparent Plastics Co.
(Massachusetts)
Plastics Service Co. (Calif.)
Plastic Supply Co. (Que., Can.)
Portal Printing & Plastic Co. (Calif.)
Somerville Limited (Ont., Can.)
Southern Plastics Co. (S.C.)
Standard Molding Corp. (Ohio)
Transparent Specialties Corp. (O.)

Cookie cutters
Bachmann Bros. Inc. (Pa.)
Plas-Tex Corp., The (Calif.)
Wecolite Company (N.Y.)

Cord
Resin Industries (Calif.)

Cord pulls
Greene Plastics (R.I.)

Control handlers
National Fabricating Co. (N.Y.)

Cosmetic boxes
Metropolitan Plastic Products Co.
(New York)
National Plastics, Inc. (Tenn.)

Cosmetic containers
A. J. & K. Company (N.Y.)
Brandwell Sales (N.Y.)
Clover Box & Mfg. Co., Inc. (N.Y.)
Emeloid Co., The (N.J.)
Mildern Mfg. Co. (N.Y.)
Na-Mac Products Corp. (Calif.)
Nussbaum, F. J. & Co. (N.Y.)
Plastifab, Inc. (Ill.)

Cosmetic items
Buchsbaum, S. & Co. (Ill.)
Chase Brass & Copper Co. (Conn.)
Clover Box & Mfg. Co., Inc. (N.Y.)

Counter tops
Cobb & Zimmer (Mich.)
General Electric Co. (Mass.)

Covers
Armstrong Cork Company (Pa.)
Atlas Moulded Products Corp.
(New York)
Clover Box & Mfg. Co., Inc. (N.Y.)
Chicopee Mfg. Corp. (N.Y.)
Rudolph, C. B. Inc. (Pa.)
White Products Co. (N.Y.)

Covers, appliance
Fabricated Products Co. (Ill.)
White Products Co. (N.Y.)

Covers (blanket, garment, pillow)
National Transparent Plastics Co.
(Massachusetts)
White Products Co. (N.Y.)

Covers (book, magazine, menu)
Clover Box & Mfg. Co., Inc. (N.Y.)
Portal Printing & Plastic Co. (Calif.)
Risch, H. Celluloid Products (N.Y.)

Covers, cake
Clover Box & Mfg. Co., Inc. (N.Y.)
Dawson Company (Ohio)

Covers, food
Fabricated Products Co. (Ill.)
Hunton Plastics Co. (N.J.)
Nu-World Products Co. (Calif.)

Covers, hat
White Products Co. (N.Y.)

Covers, instrument
Clover Box & Mfg. Co., Inc. (N.Y.)

Covers, table
National Transparent Plastics Co.
(Massachusetts)
Standard Coated Products (N.Y.)

Crochet hooks
Tilton & Cook Co. (Mass.)

Crystals
Emeloid Co., The (N.J.)
Felsenthal, G. & Sons (Ill.)

Crystals (clock, watch)
Emeloid Co., The (N.J.)
Germanow-Simon Machine Co.
(New York)

[CRYSTALS] Cont.

National Transparent Plastics Co. (Massachusetts)
Sillcocks-Miller Co., The (N.J.)

Crystels, instrument

Emeloid Co., The (N.J.)
Germanow-Simon Machine Co. (New York)

Crystels, radio

Cellulose Products Company (Calif.)
Sillcocks-Miller Co., The (N.J.)

Cups

Die-Plast Co., Ltd. (Que., Can.)
Gem Plastics Co. (Calif.)
Modglin Co. (Calif.)
Plas-Tex Corp., The (Calif.)

Cups, collepsible

Plastic Die & Tool Corp. (Calif.)
Wecolite Company (N.Y.)

Cups, meesuring

Plas-Tex Corp., The (Calif.)
Wecolite Company (N.Y.)

Curtain hooks, rings, tiebecks

Emeloid Co., The (N.J.)
Jamison, H. (Mich.)
Monaplastics, Inc. (Conn.)
Plastic Die & Tool Corp. (Calif.)

Curtains (shower, window)

Art Textile Decorating Co. (N.Y.)
Bortman Plasties Co. (Mass.)
Buchsbaum, S. & Co. (Ill.)
Fabricated Products Co. (Ill.)
Hygiene Shower Curtain Mfg. Co. (New York)
Lamotex Corp. (N.Y.)
Nonpareil Mfg. Co. (N.Y.)
White Products Co. (N.Y.)

Cutlery

Bachmann Bros. Inc. (Pa.)
Bryant Eelectric Co., The, Hemco Plastics Division (Connecticut)
Emeloid Co., The (N.J.)
Hunton Plastics Co. (N.J.)
Kilgore Mfg. Co., The (Ohio)
Majestic Plastic Co., Inc. (Fla.)
Mastercraft Plastics Co., Inc. (New York)
Pyro Plastics Co. (N.J.)
Standard Products Co., The (Mich.)
Victory Mfg. Co. (Ill.)

Cutlery hendles

Na-Mac Products Corp. (Calif.)
National Transparent Plastics Co. (Massachusetts)
Perlman, A., Plastics, Inc., (N.Y.)

Cutters, ceke

Caldwell Products, Inc. (N.Y.)
Emeloid Co., Inc. (N.J.)
Lifetime Plastics, Inc. (Colo.)
Stack Plastics Co. (Calif.)

Decalcomenies

American Decalcomania Co. (Ill.)
Donner Mfg. Co. (Ohio)
International Decalcomania Co., The (New York)
Meyercord Co., The (Ill.)
Wells, L. C. (N.Y.)

Decorative items

Borkland Laboratories (Ind.)
Chase Brass & Copper Co. (Conn.)
Galbas, Ferdinand F. (N.Y.)
Gits Molding Corp. (Ill.)
Hoosier Cardinal Corp. (Ind.)
Newport, J. Herbert Jr. (Penna.)
Plasticrest Products (Ill.)
Syracuse Ornamental Co., Inc. (New York)

Deep-freeze units

Calplasti Corporation (Calif.)

Deflectors, wind

Nu-World Products Co. (Calif.)

Dental plestics

Coralite Dental Products Co. (Ill.)
Cosmos Dental Products Co., Inc. (New York)
Peters Chemical Mfg. Co. (Ill.)
Stalite, Inc. (N.Y.)
Zenith Chemical Co. (Ill.)

Dentel products

Austenal Laboratories, Inc. (N.Y.)
Ingersoll Plastics Co., (N.J.)
Stalite, Inc. (N.Y.)

Desk sets, bases

New Onyx Plastic & Novelty Co. (New York)
Plasticraft Specialties (Ill.)
Victory Aircraft Corp. & International Plastics (California)

Diel parts

C. M. Plastic Molding Co. (N.J.)
Emeloid Co., The (N.J.)
Mildern Mfg. Co. (N.Y.)

Diels

Felsenthal, G. & Sons (Ill.)
Folsom Engraving Co. (Mass.)
Gemloid Corporation (N.Y.)
Hopp Press, The Inc. (N.Y.)
Micarta Fabricators, Inc. (Ill.)
Mildern Mfg. Co. (N.Y.)
Mitchell, F. L. Co. (Calif.)

[DIALS] Cont.

Sillocks-Miller Co., The (N.J.)
T-Die Cast & Molded Products (Cal.)
Virginia Plak Co. (N.Y.)
Willson Magazine Camera Co. (Pa.)

Dice

A. & L. Mfg. Co. (N.Y.)
Consolidated Industries (Ill.)
Elkloid Company, The (R.I.)
Imperial Molded Prod. Corp. (Ill.)
Lapin Products, Inc. (N.J.)
Levien, Ned G. Inc. (N.Y.)
Lifetime Plastic, Inc. (Colo.)
Lowe, E. S., Co. (N.Y.)
Mastercraft Plastics Co., Inc. (N.Y.)
Precision Molded Plastics, Inc. (O.)

Dishes

Bryant Electric Co., The (Conn.)
Canadian General Electric Co. (Ontario, Canada)
Dandy Plastic Products Co., Inc. (New York)
Hydropack (Calif.)
Keyes Fibre Company (Me.)
Nichols Plastic & Engineering Co. (California)
Plas-Tex Corp. (Calif.)
Rainbow Plastic Ltd. (Ont., Can.)
Watertown Mfg. Co. (Conn.)

Dispensers

Clark, Victor Marion Co. (N.Y.)
Ingwersen Manufacturing Co., Inc., (Colorado)
Na-Mac Products Corp. (Calif.)
Plastal Specialties Co. (Wash.)
Plas-Tex Corp., The (Calif.)
Plastic Die & Tool Corp. (Calif.)
Plastics, Inc. (Minn.)

Displey accessories, fixtures

Abar Plastics Company (Pa.)
Acrylite Products Inc. (N.Y.)
Algerley Laboratories (Pa.)
Amos Molded Plastics (Ind.)
Artistic Plastics Co. (N.Y.)
Cadillac Plastic Co. (Mich.)
Champion Display Material Co. (Washington)
Clark, Victor Marion Co. (N.Y.)
Craft Service (N.Y.)
Crystal Fixtures Company (Ill.)
Die-Plast Co. Ltd. (Que., Can.)
Erisman, A. C. (Pa.)
House of Plastics (Ohio)
Hyproducts Corporation (N.Y.)
Lee, Oscar (Ill.)
Lee Plastics (Pa.)
McDowell Plastic Company (Ill.)
Mildern Mfg. Co. (N.Y.)
Pikes Peak Plastics (Colo.)
Scheuer Mfg. Co. (N.Y.)
Straus & Stingo, Inc. (N.Y.)
Tech-Craft Plastics, Inc. (Wash.)
Transplastics Fabricating Co. (Mass.)
Universal Products (Cal.)
Vine-Ite Plastics Co. (Colo.)

Displeys

Artcraft Plastics Corp. (N.Y.)
Artistic Plastics (N.Y.)
California Plastic Novelties (L.A.)
Clover Box & Mfg. Co., Inc. (N.Y.)
Cournand, E. L. & Company (N.Y.)
Crafts, Inc. (R.I.)
Donovan Smith & Associates (Pa.)
Duranol Products Inc. (N.Y.)
Fixmobil Co. (N.Y.)
Galbas, Ferdinand F. (N.Y.)
Hermant, Percy Limited (Ont., Can.)
Industrial Art, Inc., (Ill.)
Johnston Industrial Plastics, Ltd. (Ontario, Canada)
Lustra-Cite Industries (N.Y.)
Mildern Mfg. Co. (N.Y.)
Miracle Plastic Mfg. Co. (N.Y.)
Robinson Industrial-Crafts, Ltd. (Ontario, Canada)
Schneider, Eugene S. (Cal.)
Shoe Form Company, Inc. (N.Y.)
Solar Plastic Products Co. (N.Y.)
Somerville Limited (Ont., Can.)
Tech-Craft Plastics, Inc. (Wash.)
Technical Plastics Lab. (Calif.)
Transparent Specialties Corp. (O.)
Transplastics Fabricating Co. (Mass.)
Tray-Ware Inc. (Ohio)
Zippy Corporation (Wash.)

Dominoes

A. & L. Mfg. Co. (N.Y.)
Elkloid Company, The (R.I.)
Lifetime Plastic, Inc. (Colo.)
Lowe, E. S. Co. (N.Y.)
National Fabricating Co. (N.Y.)
Stockton, E. M. (Ill.)

Door pletes

Clover Box & Mfg. Co. (N.Y.)
Continental Plastic Corp. (Ill.)
Gits Molding Co. (Ill.)

Doughnut cutters

Plas-Tex Corp., The (Calif.)
Wecolite Company (N.Y.)

Drefting instruments

C-Thru Ruler Co. (Conn.)
Emeloid Co., The (N.J.)
Sillcocks-Miller Co., The (N.J.)
Virginia Plak Co. (N.Y.)

Drein stoppers

Columbus Plastic Products, Inc. (O.)
Emeloid Co., The (N.J.)
Kampa Mfg. Co. (Wis.)

Drepery fixtures, hardwere

General Plastic Products (Mich.)
Greene Plastics (R.I.)
Plasti-Glo Mfg. Co. (Ill.)
Timely Novelty Co. (N.Y.)

Drewer pulls

A. & L. Mfg. Co. (N.Y.)
Cluthe, George Mfg. Co. Ltd. (Ontario, Canada)
Continental Plastic Corp. (Ill.)
Lawrence & Hunter (Calif.)
Watertown Mfg. Co. (Conn.)

Dresser sets

Emeloid Co., The (N.J.)
French Ivory Products Ltd., The (Ontario, Canada)
Gemloid Corporation (N.Y.)
Metaltex, Inc. (N.Y.)

Dust pens

Kampa Mfg. Co. (Wis.)
Plastic Die & Tool Corp. (Calif.)
Plastic Molded Products, Inc. (California)

Dust respiretors

Mine Safety Appliances Co. (Pa.)

Electricel appliences, parts

Bakoring, Inc. (Tex.)
C. M. Plastic Molding Co. (N.J.)
Clover Box & Mfg. Co., Inc. (N.Y.)
Dominion Plastics Limited (Quebec, Canada)
Irvington Varnish & Insulator Co. (New Jersey)
Kenilworth Plastics Molding Co. (N.J.), (div. Eureka Button Co.)
Plastimold, Inc. (Mass.)
Watertown Mfg. Co. (Conn.)

Electricel equipment (see also Fuses, Insulators & parts, Plugs)

Bakoring, Inc. (Tex.)
Clover Box & Mfg. Co., Inc. (N.Y.)
Howard Manufacturing Corp. (Ia.)
Littelfuse Inc. (Ill.)
Micarta Fabricators, Inc. (Ill.)
Wesco Products (Calif.)

Envelopes

American Plastic Products (Calif.)
Central Envelope Co. (N.Y.)
Dawson Company (Ohio)
Emeloid Co., The (N.J.)
Hopp Press, The Inc. (N.Y.)
National Transparent Mfg. Co. (New York)
Plastics Service Co. (Calif.)
Portal Printing & Plastic Co. (Calif.)
Rudolph, C. B. Inc. (Pa.)
Sewell Mfg. Co. (Mich.)

Escutcheons

Felsenthal, G. & Sons (Ill.)
Gemloid Corporation (N.Y.)
Magnetic Plastics Co. (O.)

Eyelets

Kirk, F. J., Molding Co. (Mass.)

Eye shedes, shields

Craft Service (N.Y.)
Elkloid Company, The (R.I.)
Kerr, R. W. Co., (Nebr.)
Mayfair Plastics Division (N.J.)

Febrics

Chicopee Mfg. Corp. (N.Y.)
Firestone Industrial Products Co. (Ohio)
Owens-Corning Fiberglas Corp. (O.)
Sport Products Inc. (Ohio)

Festeners, beby blenket

Federal Tool Corporation (Ill.)

Ferrules

Jamison, H. (N.Y.)
Zippy Corporation (Wash.)

Film conteiners

Plastal Specialties Co. (Wash.)

Filters

Gordon, J. M. (N.Y.)
Universal Plastics Corp. (N.J.)

Finishes (floors, walls)

Perma-Plastic-Seal Co. (Mich.)
Staminite Corporation, The (Conn.)

Fire extinguishers

American-LaFrance-Foamito Corp. (New York)

Fishing equipment, supplies

Cal-Pacific Co. (Calif.)
Cruver Manufacturing Co. (Ill.)
Minnesota Plastics Corp. (Minn.)
Plano Molding Co. (Ill.)
Plastal Specialties Co., (Wash.)
Zippy Corporation (Wash.)

Fixtures

Clover Box & Mfg. Co., Inc. (N.Y.)
General Plastics Corp. (Ind.)
Technical Plastics Lab. (Calif.)
Waterbury Companies (Conn.)
Western Plastics Ltd. (B. C., Can.)

Flashlights

Gemloid Corporation (N.Y.)
Gits Molding Corp. (Ill.)

[FLASHLIGHTS] Cont.

Lifetime Plastic, Inc. (Colo.)
Plano Molding Co. (Ill.)
Standard Molding Corp. (Ohio

Flesks

Standard Molding Corp. (Ohio

Flower pots, holders

Customcraft Plastic Co. (N.Y.)
Multi-Plex Mfg. Co. (Calif.)
Robinson Industrial-Crafts, Ltd (Ontario, Canada)
T-Die Cast & Molded Products (California)
Technical Plastics Co. (Ohio)

Flowers

Miya Flower & Novelty Co. (N.Y.
Plastic Projects, (N.Y.)

Food conteiners

Watertown Mfg. Co. (Conn.)

Fremes

Ben-Art Novelty Co., Inc. (N.Y.)
Classic Studio (N.Y.)
Galhas, Ferdinand F. (N.Y.)
Lucigem Plastic Corp. (N.Y.)
Multi-Plex Mfg. Co. (Calif.)
Plastic Wood Crafts (Ohio)
Starlight Jewelry & Novelty Co. (New York)
Technical Plastics Co. (Ohio)

Fremes, mirror

Consolite Corp. (Ohio)
Emeloid Co., The (N.J.)
International Plastics Products (California)
Plas-Tex Corp., The (Calif.)
Plastimode Novelty Co. (N.Y.)
Precision Specialties (Calif.)
Prolon Plastics (Mass.)

Fremes, picture

Almac Plastics, Inc. (N.Y.)
Amos Molded Plastics (Ind.)
California Giftware (Calif.)
Consolite Corp. (Ohio)
Continental Plastic Corp. (Ill.)
Customcraft Plastic Co. (N.Y.)
Emeloid Co., The (N.J.)
International Plastics Products (California)
Levien, Ned G. Inc. (N.Y.)
Plastic Laminating Co. (Calif.)
Plastic Process Co. (Calif.)
Plasti-Mode Novelty Co. (N.Y.)
Precision Specialties (Calif.)
Risch, H. Celluloid Products (N.Y.
Vargish & Company (N.Y.)
World Plastic Mfg. Co. (N.Y.)
Wynn Mfg. Co. (Pa.)
Yeager, Joesph E. (Pa.)
Zippy Corporation (Wash.)

Funnels

B. W. Photo Utilities (Calif.)
Bryant Electric Co., The (Conn.)
Kilgore Mfg. Co., The (Ohio)
Plas-Tex Corp., The (Calif.)
Standard Plastic Industries (Ill.)
Vlchek Tool Co., The (Ohio)

Furniture

Airplastics Co. (Calif.)
Artek-Pascoc, Inc. (N.Y.)
Classic Studio (N.Y.)
Cournand, E. L. & Company (N.Y.
Damascus Furniture Corp. (Va.)
Eldorado Mfg. Co. (Calif.)
Enka Plastic Company, (Calif.)
Galbas, Ferdinand F. (N.Y.)
Grosfeld House, Inc. (N.Y.)
House of Plastics (O.)
Industrial Art, Inc. (Ill.)
Lawrence and Hunter (Calif.)
Lee Plastics (Pa.)
Mildern Mfg. Co. (N.Y.)
National Plastic Products Co. (Michigan)
Pikes Peak Plastics (Colo.)
Plastic Plywood Products Co. (Ark
Plastic Products Co. (Ohio)
Plastic Wood Crafts (Ohio)
Regal Plastic Company (Mo.)
Schneider, Eugene S. (Calif.)
Syracuse Ornamental Co., Inc. (New York)
Technical Plastics Lab. (Calif.)

Furniture, doll house

Mattel Creations (Calif.)

Furniture perts, eccessories

Electroforming Company (Wis.)
Eveready Hardware Mfg. Co., I (New York)
Mildern Mfg. Co. (N.Y.)
White, Thos. J. Plastics Co. (Mo.)

Fuses and perts

Littelfuse Inc. (Ill.)
Zippy Corporation (Wash.)

Gemes end parts

A. & L. Manufacturing Co. (N.Y.)
Emeloid Co., The (N.J.)
Gits Molding Corp. (Ill.)
Levien, Ned G. Inc. (N.Y.)
Mastercraft Plastics Co., Inc. (N.Y.)
National Fabricatiug Co. (N.Y.)
Plastics Service Co. (Wis.)
Precision Specialties (Calif.)
Synthetic Plastics Sales Co. (N.Y.)

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Garters
Buchsbaum, S. & Co. (Ill.)

Gaskets
Detroit Gasket & Mfg. Co. (Mich.)
Irvington Varnish & Insulator Co. (New Jersey)

Gear blanks
Modern Plastics Corp. (Mich.)
Zippy Corporation (Wash.)

Gears
Bangor Plastics, Inc. (Mich.)
Gatke Corporation (Ill.)
General Electric Co. (Mass.)
Greaves Machine Tool Co. (O.)

Gear-shift balls
A. & L. Mfg. Co. (N.Y.)
American Insulator Corp. (Pa.)
Mildern Mfg. Co. (N.Y.)
Santay Corp. (Ill.)

Giftware
California Craftsmen (Calif.)
California Giftware (Calif.)
Chase Brass & Copper Co. (Conn.)
Elzac (Calif.)
Emeloid Co., The (N.J.)
Galbas, Ferdinand F. (N.Y.)
Hoffman Mfg. Co. (N.Y.)
House of Plastics, The (Calif.)
Industrial Art, Inc., (Ill.)
Johnston Industrial Plastics, Ltd. (Ontario, Canada)
Lee Plastics (Pa.)
Lustra-Cite Industries (N.Y.)
McDowell Plastic Company (Ill.)
Mark Novelty Corp. (N.Y.)
Metaltex, Inc. (N.Y.)
Mildern Mfg. Co. (N.Y.)
Neo Designs Co. (N.Y.)
Plastic Products Co. (Ohio)
Plastics Projects (N.Y.)
Regal Plastic Company (Mo.)
Schneider, Eugene S. (Calif.)
Solar Plastic Products Co. (N.Y.)
Sward, H. A. Co. (N.Y.)
Yeager, Joseph E. (Pa.)

Glass holders
Technical Plastics Co. (Ohio)

Glasses, baverage
Davies, Harry Molding Co. (Ill.)
Lifetime Plastic, Inc. (Colo.)
Wayne Plastic Products (Ind.)

Glazing, wira rainforcad
Celanese Plastics Corp. (N.Y.)

Goggles
Columbia Protektosite Co., Inc. (New Jersey)
Davis, Joseph Plastics Co. (N.J.)
Dockson Corporation (Mich.)
Stack Plastics Co. (Calif.)

Golf tees, jackets
Buchsbaum, S. & Co. (Ill.)
Granby Mfg. Co. (Que., Can.)

Grommets
Bachmann Bros., Inc. (Pa.)
Mildern Mfg. Co. (N.Y.)
Parisian Novelty Co. (Ill.)

Grill plates
Nichols Plastic & Engineering Co. (California)
Plas-Tex Corp., The (Calif.)

Guards
Atlas Moulded Products Corp. (New York)
Plastic Wood Crafts (Ohio)

Hair ornaments
Aceteloid Novelty Co. (N.Y.)
Whyte Mfg. Co., Inc. (N.Y.)

Hairpins
Dominion Comb & Novelty Co. (Quebec, Canada)
Granby Mfg. Co. (Que., Can.)
Tilton & Cook Co. (Mass.)

Hammars
Cluthe, George Mfg. Co. Ltd. (Ontario, Canada)

Hampers
Van Arnam Mfg. Co. (Ind.)

Handbag accassories, ornamants
California Plastic Novelties (Calif.)
Central Plastics, Inc. (N.Y.)
Die-Plast Co. Ltd. (Que., Can.)
Emeloid Co., The (N.J.)
Gemloid Corporation (N.Y.)
Hoffman Mfg. Co. (N.Y.)
Hyproducts Corporation (N.Y.)
King Plastics Corp. (Colo.)
Kingman, E. B. Co. (Mass.)
Leifer & Katz (N.Y.)
Levien, Ned G. Inc. (N.Y.)
Neo Plastics Products Co. (N.Y.)
Plasticrest Products (Ill.)
Plastimode Novelty Co. (N.Y.)
Solar Plastic Products Co. (N.Y.)
Starlight Jewelry & Novelty Co. (New York)
Straus & Stingo, Inc. (N.Y.)
Superior Plastics Corp. (N.Y.)
Supreme Plastic Mfg. Co. (N.Y.)

Handbag frames
Aceteloid Novelty Co. (N.Y.)
Associated Plastics (N.Y.)
Celoid Mfg. Company (N.Y.)
Die-Plast Co. Ltd. (Que., Can.)
Hoffman Mfg. Co. (N.Y.)
Kingman, E. B. Co. (Mass.)
Leifer & Katz (N.Y.)
Ross Plastic Co., Inc. (N.Y.)
Starlight Jewelry & Novelty Co. (New York)
Tilton & Cook Co. (Mass.)

Handbag handles
Die-Plast Co. Ltd. (Que., Can.)
Ross Plastic Co., Inc. (N.Y.)

Handbags
R. Appel (N.Y.)
Bienen-Davis, Inc. (N.Y.)
Coblentz Bag Co., Inc. (N.Y.)
Lapin Products, Inc. (N.J.)
Make Well Leather Goods Co. (N.Y.)
Plastic Hand Bag Corp. (N.Y.)
Ritter & Ritter (N.Y.)
Robbins & Weitz, Inc. (N.Y.)

Handle ornaments
H. M. Musser & Co., Inc. (Pa.)

Handlas
American Plastic Mfg. Co. (Ill.)
Breyer Molding Co. (Ill.)
Cameo Novelty Co. (N.Y.)
Chicago Molded Products Corp. (Ill.)
Clover Box & Mfg. Co., Inc. (N.Y.)
Davies, Harry Molding Co. (Ill.)
Federal Tool Corporation (Ill.)
Gits Molding Corp. (Ill.)
Globe-Imperial Corp. (Ill.)
Grigoleit Company, The (Ill.)
Imperial Molded Products Corp. (Illinois)
Kurz-Kasch, Inc. (Ohio)
Levien, Ned G. Inc. (N.Y.)
Lucigem Plastic Corp. (N.Y.)
Magnetic Plastics Co. (O.)
Mark Novelty Corp. (N.Y.)
Mastercraft Plastics Co., Inc. (N.Y.)
Mitchell Button Co. (Ont., Can.)
Starlight Jewelry & Novelty Co. (New York)
Stokes, Joseph Rubber Co., Ltd. (Ontario, Canada)
T-Die Cast & Molded Products (California)
Turner Plastic Products Co. (Mo.)
Victory Mfg. Co. (Ill.)

Hangers
Consolidated Molded Products Corp. (Pennsylvania)
Continental Plastic Corp. (Ill.)
Kingman, E. B. Co. (Mass.)
McDonald Mfg. Co. (Calif.)
National Bronze Studios (Calif.)
Schwab & Frank, Inc. (Mich.)
Victory Mfg. Co. (Ill.)

Hardware
Art Plastics Co. (Calif.)
Art Plastics Mfg. Co. (Calif.)

Harmonicas
Harmonic Reed Corp. (Pa.)

Hat boxes
Duranol Products, Inc. (N.Y.)
General Plastics Corp. (Ind.)
Metropolitan Plastic Products Co. (New York)
Transparent Specialties Corp. (O.)

Hearing aid cases
Maico Co., Inc. The (Minn.)

Hearing aid plugs
American Plastic Mfg. Co. (Ill.)

Hinges
Plastic Process Co. (Calif.)

Hooks
Emeloid Co., The (N.J.)
National Fabricating Co. (N.Y.)

Hooks (coat, hat)
Kampa Mfg. Co. (Wis.)
Pyro Plastics Co. (N.J.)

Hooks, shower curtain
Timely Novelty Co. (N.Y.)

Hose
American Extruded Products Co. (California)
Hewitt Rubber Corp. (N.Y.)

Hosa nozzles
Plastic Die & Tool Corp. (Calif.)

Hospital supplies
California Giftware (Calif.)

Housahold appliances, items
Art Plastics Co. (Calif.)
Art Plastics Mfg. Co. (Calif.)
Artcraft Plastics Corp. (N.Y.)
Bentek Company (N.Y.)
California Plastic Novelties (Calif.)
Clark, Victor Marion Co. (N.Y.)
Cunningham, W. W. Co. (Kan.)
Davies, Harry Molding Co. (Ill.)
Everbest Plastic Corporation (N.Y.)
General Plastic Products (Mich.)
Herman, J. B. (Mass.)
Hollywood Plastic Arts (Cal.)
Maico Co., Inc., The (Minn.)

[HOUSEHOLD ITEMS] Cont.
Plastimold, Inc. (Mass.)
Specialty Insulation Mfg. Co., Inc. (New York)

Houseware
B. W. Photo Utilities (Calif.)
Bryant Electric Co., The (Conn.)
Emeloid Co., The (N.J.)
Maple Leaf Plastics Ltd. (Ont., Can.)
Plastic Die & Tool Corp. (Calif.)
Pycolite Plastics Corp. (N.Y.)
Schneider, Eugene S. (Cal.)
Standard Products Co., The (Micb.)
Transparent Specialties Corp. (Obio)
Wynn Mfg. Co. (Pa.)

Housings
Andover Kent Aviation Corp. (N.J.)
Levien, Ned G. Inc. (N.Y.)
Peerless Products (Ill)

Humidors
Dorian Studio (Calif)
National Fabricating Co. (N.Y.)

Ice crushers
Dazey Corporation (Mo.)

Ice tubs
Andover Kent Aviation Corp. (N.J.)

Identification cards, tags
Darco Plastics Co. (Mass.)
Emeloid Co., The (N.J.)
Plas-Tex Corp., The (Calif.)
Risch, H. Celluloid Products (N.Y.)

Index tabs
Cel-U-Dex Corporation (N.Y.)

Indexas, talephone
Ritter, H. F. & Co. (N.Y.)
Universal Plastics Corp. (N.J.)

Infants' novaltias, specialties
Athol Comb Co. (N.Y.)
B. W. Photo Utilities (Calif.)
Clarolyte Company (N.Y.)
Mattel Creations (Calif.)
Precision Specialties (Calif.)
Voges Manufacturing Co. (N.Y.)

Infants' tableware
B. W. Photo Utilities (Calif.)
Bachmann Bros. Inc. (Pa.)
Bryant Electric Co., The (Conn.)
Nichols Plastic & Engineering Co. (California)
Plano Molding Co. (Ill.)
Plas-Tex Corp., The (Calif.)
Precision Specialties (Calif.)
Standard Plastic Industries (Ill.)

Infants' waar
Art Textile Decorating Co. (N.Y.)
Bortman Plastics Co. (Mass.)
Lamotex Corp. (N.Y.)
Rand Rubber Company (N.Y.)
White Products Co. (N.Y.)

Inkwells
Amos Molded Plastics (Ind.)

Insignia
Cellulose Products Company (Calif.)

Instrument panels
Mitchell, F. L. Co. (Calif.)

Instrument and parts
Emeloid Co., The (N.J.)
Permochart Co., The (Pa.)
Portal Printing & Plastic Co. (Calif.)

Insulators and parts
Andover Kent Aviation Corp. (N.J.)
Emeloid Co., The (N.J.)
Inceloid Co., Inc. (La.)
Majot Automatic Machine Co., Inc. (New Jersey)
Mildern Mfg. Co. (N.Y.)
National Fabricating Co. (N.Y.)
National Varnished Products Corp. (New Jersey)
Phillipe Electrical Works, Ltd. (Ontario, Canada)
Watertown Mfg. Co. (Conn.)

Jars
Norton Laboratories, Inc. (N.Y.)

Jawelry
Aceteloid Novelty Co. (N.Y.)
Algerley Laboratories (Pa.)
Axel Plastic Button Company (N.Y.)
Berkander, George F., Inc. (R.I.)
Brier Manufacturing Company (R.I.)
Cameo Novelty Co. (N.Y.)
Central Plastics, Inc. (N.Y.)
Crafts, Inc. (R.I.)
Crafts Industry (Ont., Can.)
Cruver Manufacturing Co. (Ill.)
Electroforming Company (Wis.)
Elzac (Calif.)
Gleich, Emanuel D. (N.Y.)
Greene Plastics (R.I.)
Hermant, Percy Limited (Ont., Can.)
Hoffman Mfg. Co. (N.Y.)
Plastic Jewel Co. (N.Y.)
Lucigem Plastic Corp. (N.Y.)
Magic Novelty Co. (N.Y.)
Molnar, John E. (Mo.)
Printon Corporation (N.Y.)
R. & C. Plastic Products (R.I.)
Ronci, F. Company (R.I.)
Starlight Jewelry & Novelty Co. (New York)

[JEWELRY] Cont.
Tauber Plastics, Inc. (N.Y.)
Tilton & Cook Co. (Mass.)
Yeager, Joseph E. (Pa.)

Jawelry boxes
Algerley Laboratories (Pa.)
Almac Plastics, Inc. (N.Y.)
Cass Plasticrafters (Mich.)
Customcraft Plastic Co. (N.Y.)
Emeloid Co., The (N.J.)
International Plastics Products (California)
Plastic Wood Crafts. (Ohio)
Precision Specialties (Calif.)
Reinhold, F. E. Mfr. (Cal.)
Zippy Corporation (Wash.)

Joints
Barco Manufacturing Co. (Ill.)

Juice extractors
Dazey Corporation (Mo.)
Vichek Tool Co., The (Ohio)
Zippy Corporation (Wash.)

Key holders
Cluthe, George Mfg. Co. Ltd. (Ontario, Canada)
Crafts Industry (Ont., Can.)
Emeloid Co., The (N.J.)
Gits Molding Corp. (Ill.)
Plastal Specialties Co., (Wash.)

Key chains, rings, tags
Emeloid Co., The (N.J.)
Plasticraft Specialties (Ill.)
Syntbetic Plastics Sales Co. (N.Y

Kitchanwara
B. W. Molded Plastics (Calif.)
Bryant Electric Co., The (Conn.)
Dominion Plastics Ltd. (Que., C
Emeloid Co., The (N.J.)
Jamison, H. (Mich.)
Kilgore Mfg. Co. The (Ohio)
Na-Mac Products Corp. (Calif.)
Plas-Tex Corp., The (Calif.)
Practical Plastics, Inc. (Fla.)
Tech-Craft Plastics, Inc. (Wash.)
Vine-Ite Plastics Co. (Colo.)
Wecolite Company (N.Y.)

Kits
Cass Plasticrafters (Mich.)
Prepac (N.Y.)

Kits (Hobby)
Plastolite Co., The (Pa.)
Tecbnicraft Co. (Calif.)

Kits (Sewing)
Victory Mfg. Co. (Ill.)

Kits (Travel)
Buchsbaum, S. & Co. (Ill.)
International Plastics Products (California)
Kippy Kit Co. (Ohio)

Knitting needlas
Kingman, E. B. Co. (Mass.)

Knobs
Chicago Molded Products Corp. (I
Cluthe, George Mfg. Co. (Ont., Ca
Davies, Harry Molding Co. (Ill.)
Eastern Plastics, Inc. (Pa.)
Galbas, Ferdinand F. (N.Y.)
Globe-Imperial Corp. (Ill.)
Grigoleit Company, The (Ill.)
Imperial Molded Products Corp. (I
Kurz-Kasch, Inc. (Ohio)
Magnetic Plastics Co. (O.)
Mitchell Button Co. (Ont., Can.)
National Plastic Products Co. (Michigan)
Norton Laboratories, Inc. (N.Y.)
Plastic Research Products Lab. (
Pycolite Plastics Corp. (N.Y.)
Rainbow Plastic Ltd. (Ont., Can.
Stokes, Joseph Rubber Co. (N.J.)
Stokes, Joseph Rubber Co., Ltd. (Ontario, Canada)
Supreme Plastic Mfg. Co. (N.Y.)
T-Die Cast & Molded Products (California)
Turner Plastic Products Co. (Mo.
Watertown Mfg. Co. (Conn.)

Labels
Avery Adhesives (Calif.)
Emeloid Co., The (N.J.)
Portal Printing & Plastics Co. (California)

Lamp bases
Straus & Stingo, Inc. (N.Y.)

Lamp parts
California Plastic Novelties (Cali
King Plastics Corp. (Colo.)

Lamp shades
All Metal Screw Product (N.Y.)
Mrazek, Joseph (N.Y.)
Plastic Fabricators Co. (Calif.)
Simon, Rose (Md.)
Synthetic Plastics Sales Co. (N.Y.)

Lamps
Customcraft Plastic Co. (N.Y.)
Dorian Studio (Calif.)
Eldorado Mfg. Co. (Calif.)
Fawn Creations & Company (Md.)
Fishel-Vierling Co. (Ohio)
House of Plastics (O.)

[PS] Cont.
nce And Hunter (Calif.)
ic Plastic Co., Inc. (Fla.)
n Mfg. Co. (N.Y.)
Plex Mfg. Co. (Calif.)
al Bronze Studios (Calif.)
ite Co., The (Pa.)
r Engineering Supplies, Ltd.
tario, Canada)
cal Plastics Co. (Ohio)
al Plastic Products (Calif.)

Lenses
d Co., The (N.J.)
Corporation of America (N.Y.)

Lenses, contact
Laboratories, Inc. (N.Y.)

Letter openers
Plastics, Inc. (N.Y.)
west Plastics, Inc. (Minn.)
an, A., Plastics, Inc., (N.Y.)
l Specialties Co. (Wash.)
ex Corp., The (Calif.)
Plastics Co. (N.J.)

Letters
Molding Corp. (Ill.)
of Plastics (O.)
Oscar (Ill.)
Sign Co. (Mass.)
Art Company (Md.)
ton, E. M. (Ill.)

Level tools
nal Fabricating Co. (N.Y.)

License holders
H. Celluloid Products (N.Y.)

Lighting accessories
dian General Electric Co.
ntario, Canada)
, M. L. Co. (N.J.)

Lighting tile
n-Rodgers, Inc. (Ohio)

Lip brushes
l Mfg. Company (N.Y.)

Lipstick containers
Brass & Copper Co. (Conn.)
pa Mfg. Co. (Wis.)
rville Limited (Ont., Can.)

Luggage
pee Mfg. Corp. (N.Y.)
s, Joseph & Son (N.Y.)

Luggage handles
rn Button Works Inc. (N.Y.)
ic Process Co. (Calif.)
Plastics Co. (N.J.)
s & Stingo, Inc. (N.Y.)

Machinery parts
ring, Inc. (Tex.)
Molded Plastics (Ill.)

Magazine rack
c Plastics, Inc. (N.Y.)

Magnifiers
loid Co., The (N.J.)

Maps
, Victor Marion Co. (N.Y.)

Markers
ic Process Co. (Calif.)
hetic Plastics Sales Co. (N.Y.)

Match boxes
, F. J. Molding Co. (Mass.)
dard Molding Corp. (Ohio)

Match holders
ish & Company (N.Y.)

Mats
rican Mat Corporation (Ohio)
ns-Corning Fiberglas Corp. (O.)

Measuring scoops
ore Mfg. Co., The (Ohio)

Medical instruments
vlite Products, Inc. (N.Y.)

Medical specialties
hex Products (Ill.)
co Co., Inc., The (Minn.)
co Products (Calif.)

Mirrors
ociated Specialties Corp. (R.I.)
or-Ramel Mfg. Co. (N.Y.)
ol Comb Co. (N.Y.)
mont Plastics Co. (Calif.)
id Mfg. Company (N.Y.)
mat Corporation (N.Y.)
solite Corporation (O.)
nloid Corporation (N.Y.)
acle Plastic Mfg. Co. (N.Y.)
lti-Plex Mfg. Co. (Calif)
us & Stingo, Inc. (N.Y.)
tory Aircraft Corp. & Interna-
ational Plastics (California)

Models
nac Plastics, Inc. (N.Y.)
lay Plastics Products (Calif.)
sto Craft Miniatures (N.Y.)
nd-A-Lite Plastics Div. (Ill.)
rton Rodgers, Inc. (Ohio)
ador Plastics Corp. (N.Y.)
novan Smith & Associates (Pa.)
use of Plastics (O.)
wis, A. Steven Associates (Ill.)
Dowell Plastic Company (Ill.)
ero Instrument & Machinery Corp.
(New York)

[MODELS] Cont.
Mildern Mfg. Co. (N.Y.)
National Plastic Products Co.
(Michigan)
Plastic Center Co., Inc., (Calif.)
Plastic Design & Development Co.
(Ohio)
Plastic Mold Engineering Co.
(Michigan)
Plastics Mold Design (N.J.)
Plastolite Co., The (Pa.)
Rezolin Company, The (Calif.)
Stricker-Brunhuber Co. (N.Y.)
Utleys (N.Y.)

Moldings
Kinkead Industries, Inc. (Ill.)
Klise Manufacturing Co. (Mich.)
Plastic Process Co. (Calif.)
Waterbury Companies, Inc. (Conn.)

Money holders
Die-Plast Co. Ltd. (Que., Can.)
Emeloid Co., The (N.J.)
Neo Plastics Products Co. (N.Y.)
Vargish & Company (N.Y.)

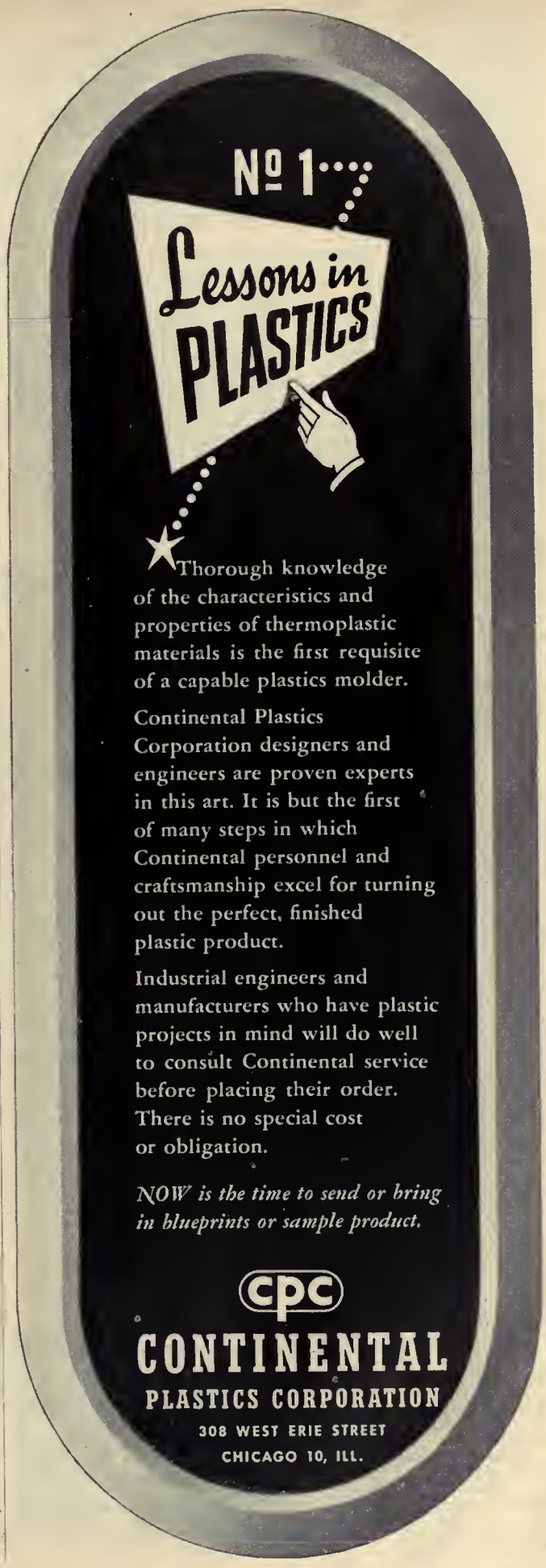
Musical instruments
Hoffman Mfg. Co. (N.Y.)
Wayne Plastic Products (Ind.)

Nameplates
Acromark Company, The (N.J.)
Ansonia Clock Co., Inc., The (N.Y.)
Carroll, J. B. Co. (Ill.)
Darco Plastics Co. (Mass.)
Emeloid Co., The (N.J.)
Felsenthal, G. & Sons (Ill.)
Folsom Engraving Co. (Mass.)
Gits Molding Corp. (Ill.)
Hopp Press, The, Inc. (N.Y.)
Kutch, Walter E. Co. (Mich.)
Mitchell, F. L. Co. (Calif.)
Peerless Roll Leaf Co., Inc., (N.J.)
Plastic Fabricators Co. (Calif.)
Plastic Projects (N.Y.)
Straus & Stingo, Inc. (N.Y.)
Virginia Plak Co. (N.Y.)
Willson Magazine Camera Co. (Pa.)

Napkin holders
Almac Plastics, Inc. (N.Y.)
Emeloid Co., The (N.J.)
Straus & Stingo, Inc. (N.Y.)
Technical Plastics Co. (Ohio)

Nozzles
C. M. Plastics Molding Co. (N.J.)

Novelties
Aceteloid Novelty Co. (N.Y.)
Art Pearl Works (N.J.)
Art Plastics Co. (Calif.)
Art Plastics Mfg. Co. (Calif.)
Artcraft Plastics Corp. (N.Y.)
Art Textile Decorating Co. (N.Y.)
Astor-Ramel Mfg. Co. (N.Y.)
Axel Plastic Button Company (N.Y.)
Berkander, George F., Inc. (R.I.)
Central Plastics, Inc. (N.Y.)
Cluthe, George Mfg. Co. Ltd.
(Ontario, Canada)
Craft Service (N.Y.)
Crafts, Inc. (R.I.)
Crafts Industry (Ont., Can.)
Cruver Manufacturing Co. (Ill.)
Die-Plast Co. Ltd. (Que., Can.)
Drell Novelty Mfg. Co., The (N.Y.)
Dulev Plastics (Ont., Can.)
Erisman, A. C. (Pa.)
Everbest Plastic Corporation (N.Y.)
Fishel-Vierling Co. (Ohio)
Fixmobil Co. (N.Y.)
Franklin Industrial Engineering
(Pennsylvania)
Gemloid Corporation (N.Y.)
Harris, Joseph & Son (N.Y.)
Herman, J. B. Co. (Mass.)
Hermant, Percy Ltd. (Ont., Can.)
Hoffman Mfg. Co. (N.Y.)
Hollywood Plastic Arts (Calif.)
Hyproducts Corporation (N.Y.)
International Plastics Products
(California)
Kenilworth Plastics Molding Co.
(New Jersey)
Kerr, R. W. Co. (Nebr.)
King Plastics Corp. (Colo.)
Kingshacher-Murphy Co. (Calif.)
Kippy Kit Co. (Ohio)
Levien, Ned G. Inc. (N.Y.)
Lindy, M. L. Co. (N.J.)
McDowell Plastic Company (Ill.)
Maple Leaf Plastics Ltd.
(Ontario, Canada)
Musser H. M. & Co., Inc. (Pa.)
Na-Mac Products Corp. (Calif.)
National Bronze Studios (Calif.)
National Plastic Co. (Calif.)
National Transparent Mfg. Co.
(New York)
Newport, J. Herbert Jr. (Pa.)
Nichols Plastic & Engineering Co.
(California)
Novelart Mfg. Co. (Calif.)
Pikes Peak Plastics (Colo.)
Plastic Process Co. (Calif.)
Plasticrest Products (Ill.)
Plastics Projects (N.Y.)
Precision Specialties (Calif.)
Premier Engineering Supplies, Ltd.
(Ontario, Canada)


No 1
Lessons in PLASTICS
Thorough knowledge of the characteristics and properties of thermoplastic materials is the first requisite of a capable plastics molder.
Continental Plastics Corporation designers and engineers are proven experts in this art. It is but the first of many steps in which Continental personnel and craftsmanship excel for turning out the perfect, finished plastic product.
Industrial engineers and manufacturers who have plastic projects in mind will do well to consult Continental service before placing their order. There is no special cost or obligation.
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CONTINENTAL
PLASTICS CORPORATION
308 WEST ERIE STREET
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[NOVELTIES] Cont.
R. & C. Plastic Products (R.I.)
Ross Plastic Co., Inc. (N.Y.)
Rothco Products (Pa.)
Solar Plastic Products Co. (N.Y.)
Speed-Cutting, Inc. (Calif.)
Sterling Plastic Products Co. (Ohio)
Superior Plastics Corp. (N.Y.)
Tech-Craft Plastics, Inc. (Wash.)
Technical Plastics Lab. (Calif.)
Thor-Sal Plastic Products (Calif.)
Tilton & Cook Co. (Mass.)
Transplastics Fabricating Co., (Massachusetts)
United Plastic Co. (Mass.)
Vine-Ite Plastics Co. (Colo.)
World Plastic Mfg. Co. (N.Y.)

Numerals
Lynn Sign Co. (Mass.)
Solid-Art Company (Md.)

Office supplies
Ohio Plastic Co., The (Ohio)

Optical parts
National Varnished Products Corp. (New Jersey)
Polaroid Corp. (Mass.)
Radio Corp. of America (N.Y.)

Ornaments
Aceteloid Novelty Co. (N.Y.)
Associated Plastics (N.Y.)
Celoid Mfg. Company (N.Y.)
Drell Novelty Mfg. Co., The (N.Y.)
Lucigem Plastic Corp. (N.Y.)
Perlman, A., Plastics, Inc., (N.Y.)
Ronci, F. Company (R.I.)
Starlight Jewelry & Novelty Co. (New York)

Packaging
Clover Box & Mfg. Co., Inc. (N.Y.)
Duranol Products Inc. (N.Y.)
Inceloid Co., Inc. (La.)
Plastic Papers Co. (Ill.)
Printon Corporation (N.Y.)
Western Products Inc. (Ohio)

Paints, varnishes
Advance Solvents & Chemical Corp. (New York)
Better Finishes & Coatings, Inc. (New Jersey)
Casein Company of America (N.Y.)
Cello-Nu Products (Ill.)
Interlake Chemical Corp. (Ohio)
Plastic-Glow Co., Inc. (N.J.)
Synthetic Resins Ltd. (Ont., Can.)
Synvar Corporation (Del.)
Valentine Sugars (La.)

Panels
Darco Plastics Co. (Mass.)
Donovan Smith And Associates (Pa.)
Folsom Engraving Co. (Mass.)
Marshall, William L. Ltd. (N.Y.)
Mildern Mfg. Co. (N.Y.)
New England Box Co., The (Mass.)
Technical Ply-Woods (Ill.)
Western Plastics Ltd. (B. C., Can.)
Zippy Corporation (Wash.)

Paper (Impregnated)
Bemiss-Jason Corp. (Calif.)
Cincinnati Industries, Inc. (Ohio)
Consolidated Water Power & Paper Co. (Wis.)
Durez Plastics & Chemicals, Inc. (New York)
Fabricon Products, Inc. (Mich.)
Gillette Fibre Co. (Mass.)
Manning, John A. Paper Co., Inc. (New York)
Hammermill Paper Co. (Pa.)
Riegel Paper Corp. (N.Y.)
Russell Products Co. (Pa.)
Shellmar Products Co. (Ohio)
Southern Waxed Paper Co. (Ga.)
Specialty Papers Co. (Ohio)

Paper cup holders
Hydropack (Calif.)

Paper weights
Almac Plastics, Inc. (N.Y.)
Straus & Stingo, Inc. (N.Y.)

Pencils, mechanical
Joffe Pen Company (N.Y.)

Pen holders
Jamison, H. (Mich.)

Pens
New Onyx & Plastics Novelty Company, Inc. (New York)
National Fabricating Co. (N.Y.)

Pens, fountain
Almac Plastics, Inc. (N.Y.)
Joffe Pen Company (N.Y.)
New Onyx Plastic & Novelty Co. (New York)
Plasticraft Specialties (Ill.)

Phonograph cabinets
Molded Products Corp. (Ill.)

Phonograph needle cups
Victory Mfg. Co. (Ill.)

Photograph holders
Kingsbacher-Murphy Co. (Calif.)

Pipe racks
Customcraft Plastic Co. (N.Y.)
Dorian Studio (Calif.)

[PIPE RACKS] Cont.
Technical Plastics Co. (Ohio)
Vargish & Company (N.Y.)

Place card holders
Almac Plastics, Inc. (N.Y.)

Place mats
Brandt, Jos. & Bros. Inc. (N. Y.)
National Transparent Plastics Co., (Massachusetts)
Hotchner, C. R. & Co. (N.Y.)
Printon Corporation (N.Y.)
Risch, H. Celluloid Products (N.Y.)

Planes, recognition models
Aristo Craft Miniatures (N.Y.)
Cruver Mfg. Co. (Ill.)

Plaques
Algerley Laboratories (Pa.)
Darco Plastics Co. (Mass.)
Dawson Company (Ohio)
Kutch, Walter E. Co. (Mich.)
Long Island Engraving Co. (N.Y.)
Willson Magazine Camera Co. (Pa.)

Plates
Emeloid Co., The (N.J.)
Plastic Fabricators Co. (Calif.)

Playing card boxes
Caldwell Products, Inc. (N.Y.)
Gits Molding Corp. (Ill.)
Steiner Mfg. Co. (N.Y.)
Vargish & Co. (N.Y.)
Stack Plastics Co. (Calif.)
Waterbury Companies (Conn.)

Playing cards
Cruver Manufacturing Co. (Ill.)
Kem Plastic Playing Cards, Inc. (New York)
Technical Plastics Co. (Ohio)

Plugs
Specialty Insulation Mfg. Co., Inc. (New York)
White, S. S. Dental Mfg. Co., The (New York)

Poker chip racks
Beaman Molded Products Co. (Ore.)
Consolidated Industries (Ill.)
Gem Plastics Co. (Calif.)
Novelart Mfg. Co. (Calif.)
Thor-Sal Plastic Products (Calif.)
Victory Mfg. Co. (Ill.)

Poker chips
Accurate Molding Corp. (N.Y.)
All Metal Screw Product (N.Y.)
Amatoy Corporation (Ill.)
Auburn Button Works Inc. (N.Y.)
Beaman Molded Products Co. (Ore.)
Breyer Molding Co. (Ill.)
Gaylord & Sons, Inc. (Mich.)
General Plastic Products (Mich.)
Gits Molding Corp. (Ill.)
Kenilworth Plastics Molding Co. (div. Eureka Button Co.) (N.J.)
Lowe, E. S. Co., Inc. (N.Y.)
Magnetic Plastics Co. (O.)
Mastercraft Plastics Co., Inc. (N.Y.)
Minnesota Plastics Corp. (Minn.)
National Fabricating Co. (N.Y.)
Nichols Plastic & Engineering Co. (California)
Northeastern Molding Co. (Conn.)
Northwest Plastics, Inc. (Minn.)
Plasticraft Specialties (Ill.)
Rainbow Plastic Ltd. (Ont., Can.)
Stanton Brothers (Ill.)
Stockton, E. M. (Ill.)
Synthetic Plastics Sales Co. (N.Y.)
Technical Plastics Co. (Ohio)
United Plastic Co. (Mass.)
Victory Mfg. Co. (Ill.)
Voges Manufacturing Co. (N.Y.)

Powder containers
Almac Plastics, Inc. (N.Y.)
Classic Studio (N.Y.)
Dorian Studio (Calif.)
Emeloid Co., The (N.J.)
Franklin Industrial Engineering (Pennsylvania)
National Bronze Studios (Calif.)
Plastal Specialties Co. (Wash.)
Plastimode Novelty Co. (N.Y.)
Precision Specialties (Calif.)
Reinhold, F. E. Mfr. (Calif.)
Superior Plastics Corp. (N.Y.)
Technical Plastics Co. (Ohio)

Precision parts, instruments
Mildern Mfg. Co. (N.Y.)
Pereles Bros. Inc. (Wis.)
Rothco Products (Pa.)

Prefabricated garages, houses
Genii Corporation (Ohio)

Prosthetic devices
Chemi-Plastic Research Lab. (Calif.)
Industrial Plastics Corp. (Calif.)

Protective clothing
Mine Safety Appliances Co. (Pa.)
Nu-Lite Plastics (N.J.)
Resistoflex Corp. (N.J.)

Protractors
Emeloid Co., The (N.J.)
Folsom Engraving Co. (Mass.)
Hopp Press, The, Inc. (N.Y.)
Sillcocks-Miller Co., The (N.J.)
Stanley Mfg. Co. Ltd. (Ont., Can.)

Pulls
Galbas, Ferdinand F. (N.Y.)
Grigoleit Company, The (Ill.)
Magnetic Plastics Co. (O.)
Supreme Plastic Mfg. Co. (N.Y.)

Racks
Cass Plasticrafters (Mich.)
Novelart Mfg. Co. (Calif.)
Plastic Wood Crafts (Ohio)
Technical Plastics Co. (Ohio)

Radio cabinets
Duramold Div., Fairchild Engine & Aircraft Corp. (New York)
Mildern Mfg. Co. (N.Y.)
Molded Products Corp. (Ill.)
United Plastic & Tool Works (Calif.)
Victory Mfg. Co. (Ill.)

Radio dials
Carroll, J. B. Co. (Ill.)
Cruver Manufacturing Co. (Ill.)
Mildern Mfg. Co. (N.Y.)
Plastic Fabricators Co. (Calif.)
Sillcocks-Miller Co., The (N.J.)

Radio frequency cores
Radio Corporation of America (N.Y.)

Radio grills
Mildern Mfg. Co. (N.Y.)

Radio knob line
Chicago Die Mold Corp. (Ill.)

Radio knobs
Davies, Harry Molding Co. (Ill.)
Gits Molding Corp. (Ill.)
Kurz-Kasch, Inc. (Ohio)
Victory Mfg. Co. (Ill.)

Radio panels
Darco Plastics Co. (Mass.)

Radio parts
Borkland Laboratories (Ind.)
Emeloid Co., The (N.J.)
Gemloid Corporation (N.Y.)
Mildern Mfg. Co. (N.Y.)
Molded Products Corp. (Ill.)
Syracuse Ornamental Co., Inc. (New York)
White, Thos. J. Plastics Co. (Mo.)

Radio windows
Emeloid Co., The (N.J.)
Mildern Mfg. Co. (N.Y.)

Rainwear
Art Textile Decorating Co. (N.Y.)
Bortman Plastics Co. (Mass.)
Buchsbaum, S. & Co. (Ill.)
Fabricated Products Co. (Ill.)
Harris, Joseph & Son (N.Y.)
Jacobi, Henry K. Co. (N.Y.)
National Transparent Plastics Co. (Massachusetts)
White Products Co. (N.Y.)

Rattles
Emeloid Co., Inc. (N.J.)
Great American Plastics Co. (Mass.)
Ideal Plastics Corp. (N.Y.)
Nu-Dell Mfg. Co. (Ill.)
Ohio Plastic Co., The (Ohio)
Plastic Playthings, Inc. (N.Y.)
Voges Manufacturing Co. (N.Y.)

Razors
Dulev Plastics (Ont., Can.)
Watertown Mfg. Co. (Conn.)

Records
RCA Victor Co., Ltd. (Ont., Can.)
Radio Corp. of America (N.Y.)
Wilcox-Gay Corp. (Mich.)

Reflectors
Emeloid Co., The (N.J.)
Northeastern Molding Co. (Conn.)

Refrigerator parts
Minnesota Plastics Corp. (Minn.)
White, Thos. J. Plastics Co. (Mo.)

Religious articles
Customcraft Plastic Co. (N.Y.)
Electroforming Company (Wis.)
Emeloid Co., The (N.J.)
Jamison, H. (Mich.)
National Fabricating Co. (N.Y.)

Respirators
Nu-World Products Co. (Calif.)

Rivets
Cherry Rivet Company (Calif.)
Victory Manufacturing Co. (Calif.)

Rouge containers
Kampa Mfg. Co. (Wis.)
Kurz-Kasch, Inc., (Ohio)
National Plastics, Inc. (Tenn.)
Norton Laboratories, Inc. (N.Y.)

Rulers
Emeloid Co., The (N.J.)
Felsenthal, G. & Sons (Ill.)
Hopp Press, The, Inc. (N.Y.)
Sillcocks-Miller Co., The (N.J.)

Safety Equipment
Dockson Corporation (Mich.)

Safety lights
Modglin Co. (Calif.)

Salad bowls
Algerley Laboratories (Pa.)
Hunton Plastics Co. (N.J.)
Majestic Plastic Co., Inc. (Fla.)
Standard Products Co., The (Mich.)

Salad sets
B. W. Photo Utilities (Calif.)
General Plastics Products (Mich.)
Standard Products Co., The (Mich.)
Sterling Plastics Co. (N.J.)

Salt and Pepper Shakers
Dorian Studio (Calif.)
Federal Tool Corporation (Ill.)
Modglin Co. (Calif.)
Nicholas Plastic & Engineering Co. (California)
Specialty Insulation Mfg. Co., Inc. (New York)

Sanitary goods
Bortman Plastics Co. (Mass.)
Rand Rubber Company (N.Y.)

Scales
Emeloid Co., The (N.J.)

Scalp massagers
Kerr, R. W. Co. (Nebr.)

Scoops
Compression Molding Company of St. Louis (Missouri)
Emeloid Co., The (N.J.)
Pyro Plastics Co. (N.J.)

Scrap books
Kirk, F. J. Molding Co. (Mass.)

Screen cloth
Cbicopee Mfg. Corp. (N.Y.)

Screw drivers
Cluthe, George Mfg. Co. Ltd. (Ontario, Canada)

Screw machine parts
Kellogg Switchboard & Supply Co. (Illinois)

Screws
Mildern Mfg. Co. (N.Y.)

Separators
Mildern Mfg. Co. (N.Y.)

Servers
Federal Tool Corporation (Ill.)
Na-Mac Products Corp. (Calif.)

Sewing stands
Newell, J. O. Industries (Ontario, Canada)

Shaft couplings
Plano Molding Co. (Ill.)

Shades
Plastic-Glow Co., Inc. (N.J.)
Plastic Shade Co., The (N.Y.)
Sun-Shade Company, The (N.J.)

Shampoo capes
Fabricated Products Co. (Ill.)
Lamotex Corp. (N.Y.)

Sheeting, films
American Plastics Corp. (N.Y.)
Bakelite Corporation (N.Y.)
Catalin Corporation (N.Y.)
Chrysler Corporation (Mich.) Cycleweld Division
Dawson Company (Ohio)
Donaldson, Alice
Dow Chemical Company (Mich.)
du Pont, E. I. de Nemours & Co. Plastics Div. (New Jersey)
Firestone Industrial Prod. Co. (O.)
Goodrich, B. F. Co., The (Ohio)
Goodyear Tire & Rubber Co. (Ohio)
Halowax Products Div. (N.Y.)
Union Carbide and Carbon Corp.
Irvington Varnish & Insulator Co. (New Jersey)
Landers Corp., The (Ohio)
Marblette Corporation, The (N.Y.)
Marshall, William L. Ltd. (N.Y.)
Monsanto Chemical Co., Plastics Div. (Massachusetts)
National Plastic Products Co. (Michigan)
Nixon Nitration Works (N.J.)
Nu-Lite Plastics (N.J.)
Penn Fibre & Specialty Co. (Pa.)
R. & C. Plastic Products (R.I.)
Rand Rubber Company (N.Y.)
Reyam Plastic Products Co. (Ill.)
Rohm & Haas Company (Pa.)
Bortman Plastics Co. (Mass.)
Sewell Mfg. Co. (Mich.)
Sillcocks-Miller Co., The (N.J.)
Spartan Industrial Corp.
Surprenant Electrical Insulation Co. (Massachusetts)
Udylite Corporation, The (Mich.)
Uncas Manufacturing Co. (R.I.)
United States Stoneware Co. (Ohio)
Visking Corp., The (Ill.)
Western Products, Inc. (Ohio)
White Products Co. (N.Y.)

Shelf edging
American Extruded Products Co. (California)

Shelves
Almac Plastics, Inc. (N.Y.)
Cass Plasticrafters (Mich.)
Multi-Plex Mfg. Co. (Cal.)
Schills Manufacturing Co. (Ill.)
Tech-Craft Plastics, Inc. (Wash.)
Technical Plastics Co. (Ohio)

Shields
Mfg. Co., The (Ohio)
Products Corp. (Conn.)
Corporation (Mich.)
Co., The (N.J.)
uhber Company (N.Y.)

Shoe accessories
Plastics, Inc. (N.Y.)

Shoe heels
Bros., Inc. (Wis.)

Shoe holders
Studio (N.Y.)

Shoe horns
Co., The (N.J.)
Die & Tool Corp. (Calif.)
Plastic Co. (Calif.)

Shower doors
an Extruded Products Co.
ornia)

Signs
e Products Inc. (N.Y.)
Victor Marion Co. (N.Y.)
d Co., The (N.J.)
Ferdinand F. (N.Y.)
Harry H. & Bro. (N.Y.)
of Plastics (Ohio)
Plastics Co. (N.J.)
scar (Ill.)
Center Co., Inc., (Calif.)
Fabricators Co. (Calif.)
n, E. M. (Ill.)
n Magazine Camera Co. (Pa.)
Corporation (Wash.)

Sink strainers
atic Plastic Molding Co. (Calif.)
d Co., The (N.J.)
Mfg. Co., (Wis.)
ex Corp., The (Calif.)
Die & Tool Corp. (Calif.)
Tool Co., The (Ohio)

Sink tops
ession Molding Company of St.
s (Missouri)

Silent butlers
idated Industries (Ill.)

Sleeve, cuff protectors
H. Celluloid Products (N.Y.)

Slide rules
d Co., The (N.J.)
n (N.J.)
ks-Miller Co., The (N.J.)

Smokers' accessories
n Manufacturing Co. (N.Y.)

Soap boxes
atic Plastic Molding Co. (Calif.)
Plastic Products Co., Inc.
w York)
n Plastics, Inc (Pa.)
d Co., The (N.J.)
an, E. B. Co. (Mass.)
tic Plastics Co. (O.)
ex Corp., The (Calif.)
raft Mfg. Co. (N.J.)
old, F. E. Mfr. (Calif.)
Manufacturing Co. (Ill.)
& Cook Co. (Mass.)
l Plastic Co. (Mass.)
y Mfg. Co. (Ill.)

ap dispensers, accessories
id Co., The (N.J.)
al Tool Corporation (Ill.)
Company, The (Colo.)

Soap dishes
id Co., The (N.J.)
an, E. B. Co. (Mass.)
tic Plastics Co. (O.)
Plastic Co. (Calif.)

Spool racks
y Mfg. Co. (Ill.)

Spectacle frames
letal Screw Product (N.Y.)
ican Zyloptic Co. (N.Y.)
h & Lomb Optical Co. (N.Y.)
Optical Co. (N.Y.)
ry Optical Mfg. Co. (N.J.)

Spoons, measuring
soll Plastics Co. (N.J.)
Tex Corp., The (Calif.)

Sports goods
o Plastics (O.)
nal Research & Mfg. Co.
alifornia)
Products Inc. (Ohio)

Sprays
. Photo Utilities (Calif.)

Stampings
rate Spring Mfg. Co. (Ill.)
oid Co., The (N.J.)

Stationery items
ic Plastics, Inc. (N.Y.)
Plastics Co. (Calif.)
Plastics Mfg. Co. (Calif.)
awlik Company (N.J.)
mar Plastics Co. (Calif.)
ac (N.Y.)
h, H. Celluloid Products (N.Y.)
us & Stingo, Inc. (N.Y.)
nical Plastics Co. (Ohio)

Sunglasses
l Comb Co. (N.Y.)
mann Bros., Inc. (Pa.)
mbia Protektosite Co., Inc. (N.J.)
er Grant Co., Inc. (Mass.)

Surgical supplies
Inceloid Co., Inc. (La.)

Suspenders
Buchshaum, S. & Co. (Ill.)
Die-Plast Co., Ltd. (Que., Can.)

Swimming, shower caps
Buchsbaum, S. & Co. (Ill.)
Lamotex Corp. (N.Y.)
White Products Co. (N.Y.)

Switch illuminators, plates
Continental Plastic Corp. (Ill.)
Crafts Industry (Ont., Can.)
Gits Molding Corp. (Ill.)
McDonald Manufacturing Co. (Calif.)
Risch, H. Celluloid Products (N.Y.)

Switches
Grayhill (Ill.)

Table tops
Capac Manufacturing Co. (Mich.)
Cobb & Zimmer (Mich.)
General Electric Co. (Mass.)
Marshall, William L., Ltd. (N.Y.)

Tables
Mildern Mfg. Co. (N.Y.)
Multi-Plex Mfg. Co. (Calif.)

Tables (cocktail, coffee)
Dorian Studio (Calif.)
House of Plastics (Ohio)
Tech-Craft Plastics, Inc. (Wash.)
Technical Plastics Co. (Ohio)

Tables, end
Dorian Studio (Calif.)
Novelart Mfg. Co. (Calif.)
Tech-Craft Plastics, Inc. (Wash.)

Tables, lamp
House of Plastics (Ohio)

Tableware
Customcraft Plastic Co. (N.Y.)
Gem Plastics Co. (Calif.)
Maple Leaf Plastics Ltd. (Ont., Can.)
Nichols Plastics & Engineering Co. (California)
Nu-World Products Co. (Calif.)
Plastics, Inc. (Minn.)
Watertown Mfg. Co. (Conn.)

Tanks
Atlas Moulded Prod. Corp. (N.Y.)

Tape dispenser
Cofax Corporation, The (N.Y.)

Tapes
Acromark Company, The (N.J.)
Celluplastics Corp. (N.J.)
Cofax Corporation, The (N.Y.)
Industrial Tape Corp. (N.J.)
Irvington Varnish & Insulator Co. (New Jersey)
Owens-Corning Fiberglas Corp. (O.)
Resin Industries (Calif.)
U.S. Stoneware Co., The (Ohio)

Teething rings
Jamison, H. (Mich.)
National Fabricating Co. (N.Y.)

Telephone shoulder rest
Reyam Plastic Products Co. (Ill.)

Templates
Emeloid Co., The (N.J.)
Sewell Mfg. Co. (Mich.)

Terminal blocks
Grayhill (Ill.)

Textile machinery parts, accessories
American Hard Rubber Co. (N.Y.)
National Plastics, Inc. (Tenn.)
Plastimold, Inc. (Mass.)
Southern Plastics Co. (S.C.)

Thermometer cases
Joffe Pen Company (N.Y.)
Watertown Mfg. Co. (Conn.)

Thermometers
Emeloid Co., The (N.J.)

Thimbles
Accurate Molding Corp. (N.Y.)
Dominion Comb & Novelty Co. (Quehec, Canada)
Modglin Co. (Calif.)

Tie racks
Algerley Laboratories (Pa.)
Almac Plastics, Inc. (N.Y.)
Emeloid Co., The (N.J.)
Kingsbacher-Murphy Co. (Calif.)
Novelart Mfg. Co. (Calif.)
Speed-Cutting, Inc. (Calif.)
Wecolite Company (N.Y.)

Tile
Compression Molding Co. (Mo.)

Time table holders
Clark, Victor Marion Co. (N.Y.)
Palomar Plastics Co. (Calif.)

Tissue dispensers
Plas-Tex Corp., The (Calif.)

Tobacco pouch
Buchsbaum, S. & Co. (Ill.)
White Products Co. (N.Y.)

Toilet seats
Capac Manufacturing Co. (Mich.)
Clarolyte Company (N.Y.)
Van Arnam Mfg. Co. (Ind.)

Toilet tank floats
Kampa Mfg. Co. (Wis.)

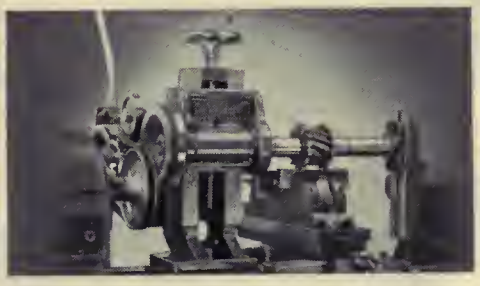
New Unit Makes Milling Machine Out of Lathe in 3 Minutes!

The Globe Miller, a unit quickly attached to a standard lathe, performs the same operations as a costly milling machine. Installed in 3 minutes or less, the Globe Miller operates almost identically to a standard milling machine. All controls are simple, highly accurate—and the miller is designed to utilize all speeds and feeds of the lathe.

It is accurate, durable and highly versatile. With minor adjustments and accessories, the miller will face castings; cut slots, keyways, and gears; perform slitting operations, etc. Quality materials and rugged construction enable it to stand the hardest use. It costs but a fraction as much as a standard miller. Its compact design makes storage possible underneath the lathe. Proved performance in wartime production, assures dependable service.

Performance has also proved that chewing gum helps you on the job—by seeming to make work go easier, time go faster. Today, you'll see good chewing gum on the market. But a shortage still exists. Wrigley's Spearmint Gum is taking this space for your information, and for now, we'd like to suggest that you use any good available brand. Remember: It's the chewing that's good for you.

You can get complete information from
Globe Products Mfg. Co., 3380 Robertson Boulevard
Los Angeles 34, California



AA-56

Tool handles
Cluthe, George Mfg. Co., Ltd.
Plasticraft Mfg. Co. (N.J.)
T-Die Cast & Molded Prod. (Calif.)

Toothbrush boxes, cases
Bryant Electric Co. (Conn.)
Clover Box & Mfg. Co., Inc. (N.Y.)
National Fabricating Co. (N.Y.)
National Transparent Plastics Co. (Massachusetts)
Plasticraft Mfg. Co. (N.J.)
Plastic Creations of Hollywood (California)
Reinhold, F. E. Mfr. (Calif.)
Somerville Limited (Ont., Can.)
Stack Plastics Co. (Calif.)
Tilton & Cook Co. (Mass.)
United Plastic Co. (Mass.)
Victory Mfg. Co. (Ill.)

Toothbrush holders
Kingman, E. B. Co. (Mass.)
Statler Manufacturing Co. (Ill.)
Technical Plastics Co. (Ohio)

Toothbrushes
Davis, Joseph Plastics Co. (N.J.)
Prolon Plastics (Mass.)
Tri-United Plastics Corp. (N.Y.)
Hughes-Autograf Brush Co., Inc. (New York)

Towel bars, brackets, racks
Almac Plastics, Inc. (N.Y.)
Kampa Mfg. Co. (Wis.)
National Bronze Studios (Calif.)
Plastic Die & Tool Corp. (Calif.)
Plastic Wood Crafts (Ohio)
Technical Plastics Co. (Ohio)

Toys, toy parts
Amatoy Corporation (Ill.)
All Metal Screw Product (N.Y.)
B. W. Photo Utilities (Calif.)
Caldwell Products, Inc. (N.Y.)
California Plastics Products Corp. (California)
Cal-Pacific Co. (Calif.)
Cluthe, George Mfg. Co. (Ont., Can.)
Consolidated Industries (Ill.)
Dandy Plastic Products Co. (N.Y.)
Dillon-Beck Mfg. Co. (N.J.)
Dulev Plastics (Ont., Can.)
Electroforming Company (Wis.)
Emeloid Co., The (N.J.)
Everhest Plastic Corporation (N.Y.)
Fihro Container Corp. (Minn.)
Howard Manufacturing Corp. (Ia.)
Hydropack (Cal.)
Ingersoll Plastics Co. (N.J.)
International Plastics Prod. (Calif.)
Irwin Corporation (N.Y.)
Levien, Ned G., Inc. (N.Y.)

[TOYS] Cont.
Maico Co., Inc., The (Minn.)
Mattel Creations (Cal.)
Neo Plastics Products Co. (N.Y.)
Nu-Dell Mfg. Co. (Ill.)
Ohio Plastic Co., The (Ohio)
Plas-Tex Corp., The (Calif.)
Plastic Art Toy Corp. of America (New Jersey)
Plastic Die & Tool Corp. (Calif.)
Plastic Process Co. (Calif.)
Plastifah, Inc. (Ill.)
Precision Specialties (Calif.)
Pyro Plastics Co. (N.J.)
Synthetic Plastics Sales Co. (N.Y.)
Tauher Plastics, Inc. (N.Y.)
T-Die Cast & Molded Products (Cal.)
United Plastic Co. (Mass.)
Victory Mfg. Co. (Ill.)
Wills & Roberts Plastics Mfg. Corp. (California)

Trays
Accurate Molding Corp. (N.Y.)
Almac Plastics, Inc. (N.Y.)
Ardee Plastics Company, Inc. (N.Y.)
Artcraft Plastics Corp. (N.Y.)
Barringham Rubber Co. (Ont., Can.)
Bolta Company, The (Mass.)
California Giftware (Cal.)
Celomat Corporation (N.Y.)
Clover Box & Mfg. Co., Inc. (N.Y.)
Commonwealth Products Co. (Pa.)
Dorian Studio (Cal.)
General Plastic Products (Mich.)
General Plastics Mfg. Co. (Wash.)
Gerber Plastic Co. (Mo.)
Hunton Plastics Co. (N.J.)
Industrial Plastics Corp. (Calif.)
Keyes Fibre Company (Me.)
Lee, Oscar (Ill.)
Majestic Plastic Co., Inc. (Fla.)
Metaltex, Inc. (N.Y.)
Mildern Mfg. Co. (N.Y.)
National Bronze Studios (Calif.)
Plasti-Mode Novelty Co. (N.Y.)
Plastolite Co., The (Pa.)
Precision Specialties (Calif.)
Reinhold, F. E., Mfr. (Cal.)
Standard Products Co., The (Mich.)
Technical Plastics Co. (Ohio)
Thor-Sal Plastic Products (Calif.)
Vargish & Company (N.Y.)
Watertown Mfg. Co. (Conn.)
Wynn Mfg. Co. (Pa.)

Tree guards
Stekert, Martin M. (N.Y.)

Tricycles
California Plastics Products Corp. (California)

Tumblers
American Plastic Mfg. Co. (Ill.)
Ardee Plastics Company, Inc. (N.Y.)
Dandy Plastic Products Co., Inc. (New York)
Kilgore Mfg. Co., The (Ohio)
Nichols Plastic & Engineering Co. (California)
Northeastern Molding Co. (Conn.)
Plano Molding Co. (Ill.)
Plas-Tex Corp., The (Calif.)
Rohinson Industrial-Crafts, Ltd. (Ontario, Canada)
Specialty Insulation Mfg. Co., Inc. (New York)
Victory Mfg. Co. (Ill.)
Vichek Tool Co., The (Ohio)
Wesolite Company (N.Y.)

Twine
Hall Line Corp. (N.Y.)

Umbrella handles
Hunton Plastics Co. (N.J.)
Hyproducts Corporation (N.Y.)
King Plastics Corp. (Colo).
Lucigem Plastic Corp. (N.Y.)
Mark Novelty Corp. (N.Y.)
Musser, H. M. Co., Inc. (Pa.)
Straus & Stingo, Inc. (N.Y.)

Vacuum cleaner parts, attachments
Emeloid Co., The (N.J.)

Valves, handwheels
Atlas Valve Company (N.J.)
Keyes Fihre Company (Me.)

Vanity sets, stands
Associated Specialties Corp. (R.I.)
Athol Comb Co. (N.Y.)
International Plastics Prod. (Calif.)
Technical Plastics Co. (Ohio)

Vases
Almac Plastics, Inc. (N.Y.)
California Giftware (Cal.)
Plasti-Mode Novelty Co. (N.Y.)
Technical Plastics Co. (Ohio)

Venetian blind pulls
So. California Plastic Co. (Calif.)

Vials
Amos Molded Plastics (Ind.)
Celluplastic Corporation (N.J.)
Plastic Supply Co. (Que., Can.)

Visors
Polaroid Corp. (Mass.)

Visual training aids
Korda Graphics (N.Y.)

Wall coverings
Cello-Nu Products (Ill.)
Standard Coated Products (N.Y.)

Wallet inserts
Empress Novelty Company (N.Y.)
National Plastic Co. (Calif.)
Plastics Service Co. (Calif.)
Precision Specialties (Calif.)
Risch, H. Celluloid Products (N.Y.)

Washers
Emeloid Co., The (N.J.)
Irvington Varnish & Insulator Co. (New Jersey)
Zippy Corporation (Wash.)

Waste baskets
General Plastic Products (Mich.)

Weather hygrometer
Nu-Dell Mfg. Co. (Ill.)

Wheels
American Brakehlok Div. (Mich.)
Cunningham, W. W., Co. (Kan.)
Howard Manufacturing Corp. (Ia.)
Plastics Service Co. (Wis.)

Whistles and parts
Plastic Engineering, Inc. (Ohio)
Watertown Mfg. Co. (Conn.)

Windows and guards
Cadillac Plastic Co. (Mich.)
Clover Box & Mfg. Co., Inc. (N.Y.)
Flex-O-Glass Mfg. Co. (Ill.)
Herman, J. B. (Mass.)
Hopp Press, The, Inc. (N.Y.)
Mildern Mfg. Co. (N.Y.)
National Transparent Plastics Co. (Massachusetts)

Windshield scrapers
Northwest Plastics, Inc. (Minn.)

Windshields
Cunningham, W. W., Co. (Kan.)

Wiring devices, forms
Accurate Spring Mfg. Co. (Ill.)
Marks Products Co., Inc. (N.Y.)
Trenton Plastic & Metals Co. (N.J.)

Work tickets
National Plastic Co. (Calif.)

Wrist bands
Buchsbaum, S. & Co. (Ill.)

Yarns
Carbide and Carbon Chemicals Corporation (N.Y.)
Firestone Industrial Prod. Co. (O.)
Plexon, Inc. (N.Y.)
Tensolite Corp., The (N.Y.)

Zipper pulls
Cass Plasticrafters (Mich.)
Die-Plast Co., Ltd. (Que., Can.)
Ross Plastic Co., Inc. (N.Y.)

One of a series . . . covering Wonders of the World. Can you name some of the others? Watch Nosco's next ad.

The Colossus of Rhodes, not unlike our own Statue of Liberty, towered over the eastern Mediterranean harbor in 200 B.C.

Many 'wonders' have been and are being done with Plastics in this modern era but their success depends largely upon the engineering ability and sincerity of the molder.

If you are now using or contemplating the use of Plastics, you should Know Nosco where years of experience and modern equipment work hand in hand for the success of Plastics.

NOSCO Plastics

DIVISION OF
NATIONAL ORGAN SUPPLY CO • ERIE, PA •

Directory of Names and Addresses

This list gives the names, addresses, branch offices and executive personnel of every manufacturer listed in the Index which begins on page 86. Information here covers the manufacturers of plastics parts and products; material, equipment and supply manufacturers; as well as other organizations and individuals associated with the plastics industry in the United States and Canada.

A. PLASTIC ASSOCIATES
...ast 42nd Street
N... York 17, New York

A. RUBBER MFG. CO. LTD.
2... Cambie Street
V... couver, British Columbia, Can.

A. & K. COMPANY
5... West 17th Street
N... York 11, New York
Pe...nnel: E. Ferna Hoffstot, owner; H... y D. Olzacki, gen. mgr.
Pr...es: Compression, 2—75 ton, 1—100 t... 1—125 ton.

A... L. MFG. CO.
9... lorence Street
Br...klyn 6, New York
P...nnel: A. J. Lodato, pres.; A. A. La...to, vice-pres.; A. M. Di Leva, t...; A. J. Smith, gen. & sales mgr.

A... C CO., INC.
...W. Chelten Avenue
P...adelphia 44, Pennsylvania
Br...ch Offices: All principal cities.
Pe...nnel: G. H. Johanson, pres.; I. ...ohanson, vica-pres.; H. E. Kanyon, ...; H. Huber Sr., plant mgr.; W. L. ..., dir. research; W. E. Winters, ... mgr.

...RON MACHINERY CO.
... Crosby Street
...w York, New York
...onnel: Jacob Fraidus.

...AR PLASTICS COMPANY
... Third Avenue
...sburgh, Pennsylvania
...onnel: John S. Forster, pres. and ...f angr.; W. Whitaoak, traas.; Joan ... Forstar, sales mgr.
...ses: Compression, 2—25 tons, 4— ...tons; Extrusion, 1—3 in.; Injection, ... oz.

...BÉ, PAUL O., INC.
... Center Avenue
...le Falls, New Jersey
...onnel: Paul O. Abbé, pres.; H. E. ...bé, vica-pras.; Oakley H. Garlick, ...y. & treas.

...BÉ ENGINEERING CO.
... Church Street
...w York 7, New York
...onnel: C. A. Beach, pras.; H. F. ...infaldt, vica-pres.; A. T. Beach, ...y.; Wm. Jordan, supt.; E. J. Beach, ...ef angr.; Philip Kriagel, adv. mgr.; ...s. Jones, pur. agant.

...BOT ENGINEERING & ...NSULATING CO.
... Broad St.
...zabeth 4, New Jersey
...sonnel: F. E. Bronson, C. & C. J. ...bola, owners.

...ERDEEN PLYWOOD CORP.
...erdeen, Washington

...LE MACHINE & TOOL ...WORKS
... W. Twenty-second St.
...w York, New York
...rsonnal: George M. Pellar, owner; ...ell Sobol, secy.; Charles Heyn, ...man.

...CADIA SYNTHETIC PRODUCTS ...DIVISION
...estern Felt Works
...19 Ogden Avenue
...icago 23, Illinois
...anch Offices: 750 Prospect Ave., ...eveland; 1416 S. Flower St., Los Angeles; 42-48 E. 20 St., New York; 1600 Locust Ave., St. Louis.
Personnel: Henry Faurot, pres., Henry Faurot Jr., vice-pres. & gen. mgr.; Charlas Devine, secy.; W. S. Faurot, traas.; H. N. Vickerman, sales mgr.; J. A. Palmer, chief engr. & dir. plastics research; E. J. Healy, adv. mgr.

ACAP COMPANY
136 Liberty Street
New York 6, New York
Personnel: H. Spahr, partner.

ACCURATE GOLD STAMPING COMPANY
208 Greene Street
New York 12, New York

ACCURATE MOLDING CORP.
116 Nassau Street
Brooklyn 1, New York
Personnel: Leo Adanbaum, pres.; David Adenbaum, vica-pres.; Salma Schwimmer, sacy.; Alax Adanbaum, treas.
Presses: Compression, 16—50 to 300 ton.

ACCURATE SPRING MFG. CO.
3811 W. Lake Street
Chicago 24, Illinois
Personnel: F. D. Wabar, pras., A. A. Bonde, vica-pras. & gan. mgr.; M. Ruman, supt.; E. H. Rundan Jr., chief engr.; Robart Hain, dir. pub. rel.; Josaphine Barger, pur. agent.

ACCURATE STEEL RULE DIE MFRS.
22 West 21st Street
New York. New York
Personnel: E. K. Scott, L. M. Scott, owners; L. M. Scott, pur. agant.

ACCURATE THREADED FASTENERS
2029 North Halsted Street
Chicago, Illinois
Personnel: Harry Burg, owner.

ACE DRILL CORPORATION
13835 Jennings Street
Detroit 27, Michigan
Personnel: Grant Folin, pras.; Burton R. Laathley, vice-pras.; Harbart Robinson, secy.; Frank R. Smith, treas.; Howard A. Haydan, chiaf angr. & pur. agent.

ACE-HY PLASTIC COMPANY
306 Bowery
New York 12, New York
Personnel: H. Berman, owner.

ACE PLASTIC NOVELTY CO.
476 Jefferson Street
Brooklyn 6, New York

ACE TOOL & MFG. CO.
532 Mulberry Street
Newark 5, New Jersey
Personnel: Charlas Kolarsick & Carl W. Kolarsick, partners.

ACELINE FILM RECLAIMING COMPANY
505 East 171st Street
Bronx, New York

ACETELOID NOVELTY CO.
203 East 18th Street
New York 3, New York
Personnel: Louis J. Lavina & Mitchell Lavine, owners.

ACHORN STEEL COMPANY
381 Congress Street
Boston 10, Massachusetts

ACKERMAN PLASTIC MOLDING
986 East 200th Street
Cleveland, Ohio

ACKERMAN, W. W., INC.
38 Park Place
New York, New York
Personnel: W. W. Ackarman, pras.; Joe Ackerman, vice-pres.; Howard Ackerman, secy.

ACKERMAN-GOULD CO.
92-96 Bleecker Street
New York, New York
Personnel: Frank Ackarman & Herman Gould, partnars.

ACME-DANNEMAN CO., INC.
203-205 Lafayette St.
New York 12, New York
Branch Shop: Danneman Die Sat Company, New York.
Personnel: Fred C. Dannaman, pras.; M. A. Dannaman, vice-pras.; William R. Himmelreich, traas.; John Wandler, supt.

ACME FOLDING BOX CO., INC.
141 E. 25th Street
New York, New York

ACME MARKING EQPT. CO.
2222 West Fort Street
Detroit 16, Michigan
Personnel: Don E. Forrastar, partner & gan. mgr.; Douglas G. Forraster, partnar & chiaf engr.; Emary S. Hendrickson, supt.

ACME PLASTIC CO.
1845 South Western Avenue
Los Angeles, California

ACRAGLAS COMPANY
1805 14th Street
Santa Monica, California

ACRO TOOL & DIE WORKS
4892 N. Clark St.
Chicago 40, Ill.

ACROMARK COMPANY, THE
9-13 Morrell St.
Elizabeth 4, New Jersey
Personnel: H. O. Bates, ownar & adv. mgr.; S. R. Rosanberg, controllar; Henry Karsten, sales mgr.; Wm. A. Haina, gan. mgr. & chiaf angr.; C. Caton, supt.; W. A. Heina Jr., chiaf chem.; D. M. Shilo, purchasing agent.

ACRYLITE PRODUCTS, INC.
1545 Inwood Avenue
New York 52, New York
Personnel: Max A. Caine, pres.; Sam Schneider, vice-pres.; Ned Augenblich, plant mgr.

ADAMS, S. G. CO.
920 Olive St.
St. Louis, Missouri
Factory: 2947 Delmar Blvd., St. Louis.
Personnel: S. S. Adams, pres.; F. K. Adams, vica-pras. & treas.; V. A. Hall, sacy.; F. D. Bryan, supt.; S. S. Adams Jr., chief angr.; H. D. Duffy, salas mgr.; Gao. S. Shaver, adv. mgr.; L. A. Patri, pur. agant.

ADAMS, WILBUR HENRY
RFD No. 1, Wolf Road
Erie, Pennsylvania

ADAMS PLASTIC PRODUCTS
309 Sycamore
Cincinnati, Ohio
Personnel: R. N. Adams, owner; M. L. Doyle, treas.; Weslay A. Weaver, gan. mgr.

ADAMSON UNITED CO.
730 Carroll Street
Akron, Ohio
Branch Offices: Bloomfield Bank & Trust Bldg., Bloomfield, N. J.; 740 S. Clark St., Chicago.
Personnel: F. L. Dawes, pres. & gen. mgr.; Andrew Hala, vice-pres. in charge of sales & engr.; Geo. Fann, asst. secy. & traas.; L. Hallar, supt.; Carl Ludwig, chief angr.

ADHERE, INCORPORATED
1220 Maple Avenue
Los Angeles 15, California

ADHESIVE PRODUCTS CORP.
1660 Boone Avenue
Bronx 60, New York
Personnel: M. P. Medwick, pres.; Irving Mintz, secy. & traas.; Frank J. Devido, supt.; James Picca, chief angr.; H. Lord, pur. agant.

ADJUSTABLE CLAMP CO.
417 North Ashland Avenue
Chicago 22, Illinois
Personnel: H. V. Holman, pres.; D. V. Holman, sacy.

ADROIT MFG. CO.
76 Gerry Street
Brooklyn 6, New York
Personnel: Ernast Young, ownar & chief cham.

ADVANCE MOLDING CORP.
54 West 21st Street
New York 10, New York

ADVANCE SOLVENTS & CHEMICAL CORPORATION
245 Fifth Avenue
New York 16, New York
Branch Office: 5B9 E. Illinois St., Chicago.
Personnel: A. L. Mullaly, pres.; E. M. Pfluager, vica-pras.; H. Stolza, sacy.; H. H. Stiller, traas.; S. Longman, plant mgr.; G. P. Mack, dir. plastics resaarch; C. A. Klebsattal, chief chamist.

AERO COMMUNICATIONS
231 Main Street
Hempstead, Long Island, N. Y.

AEROIL PRODUCTS COMPANY
57th Street & Park Avenue
West New York, New Jersey
Branch Offices: 2019-2021 S. Michigan Ava., Chicago; 3408 Main St., Dallas; 435 Bryant St., San Francisco.
Personnel: Howard C. Lyon, partner & gan. mgr.; Laurance Crosby, chg. promotion & adv. mgr.; Frad Wittig, supt.; Paul Wollnar, chiaf angr.; Edwin F. Skillman, dir. pub. rel.; Joseph Imfald, pur. agent.

AGET-DETROIT CO.
602 First National Bldg.
Ann Arbor, Michigan

AGICIDE LABORATORIES, INC.
1717 Taylor Avenue
Racine, Wisconsin
Branch Office: 4549 Bandini Blvd., Los Angalas.
Personnel: Joseph W. Ayars, pras.; Arthur J. Olsan, vica-pres.; Daan Lake Traxlar, sacy.; Thomas E. Fetan, traas.; E. M. Pagel, sales mgr.; John H. Linhardt, mgr. Los Angales Grinding Plant.

AIDS, INCORPORATED
1220 Broadway
New York, New York

AIRCRAFT DIE CUTTERS
1314 North Edgemont
Los Angeles, California

AIRCRAFT PARTS DEVELOPMENT CORPORATION
409 Broad Street
Summit, New Jersey

AIRCRAFT PLASTICS
5714 West Pico Boulevard
Los Angeles, California

AIRCRAFT SCREW PRODUCTS COMPANY, INC.
47-23 35th Street
Long Island City 1, New York
Branch Offices: 162B McGee St., Kansas City, Mo.; J. S. Wise, 523 W. 6th St., Los Angeles; 6 Pioneer Circle, Manthertor, Conn.; 201 S. Pleasant St., Royal Oak, Mich.
Personnel: Benjamin Sack, pres. & gan. mgr.; Harkness W. Cram, vice-pres. & sales mgr.; A. Loeb Salkin, secy.; Charles L. Huisking, Jr., treas.; Otto Haas, chief engr.; Charles G. Thoma, adv. mgr. & chief chem.; Harold J. Wrigley, pur. agent.

AIRCRAFT SPECIALTY CO.
601 Anderson Street
Los Angeles, California

AIRCRAFT TOOLS, INC.
750 East Gage Avenue
Los Angeles 1, California

AIRPLASTICS COMPANY
7511 State Street
Huntington Park, California
Personnel: Chas. J. Spector & James E. Lundy, partners; E. J. Warren, plant mgr.

AIRPLY FORMING COMPANY
1872 East Vernon Avenue
Los Angeles 11, California

AIRTRONICS MFG. COMPANY
5245 West San Fernando Rd.
Los Angeles 26, California

AJAX ELECTROTHERMIC CORPORATION
Ajax Park
Trenton, New Jersey

AJAX-DORET METAL PRODUCTS
18 Irwin Avenue
Toronto, Ontario, Canada

ALAN, RICHARD, BUTTON CO.
248-274 McKibbin Street
Brooklyn 6, New York

ALBERT, L. & SON
336 Whitehead Road
Trenton, New Jersey
Branch Offices: Akron; Los Angeles; Stoughton, Mass.
Personnel: S. L. Albert, pres. & sales mgr.; P. E. Albert, vice-pres. & gen. mgr.; I. A. Johnson, supt. Akron; W. A. Butcher, plant mgr. Trenton; E. R. Keller, chief engr.; F. C. Thompson, dir. pub. rel.; J. Hausman, pur. agent.

ALBION LABORATORIES
7911 Barnwell Ave.
Elmhurst, Long Island, New York
Personnel: J. Weiss, secy.; Norman Davis, chief engr.; George Baumgartl, toolroom foreman.

ALDEN PRODUCTS COMPANY
117 North Main Street
Brockton 64, Massachusetts
Personnel: Milton Alden, pres., owner & treas.; Raymond Taylor, plant supt.; R. G. Barker, customer relations dept.; Alexander Nyman, Tech. Advisor; John U. Bete, adv. mgr.; Robert A. Henry, pur. agent; J. Burns, molding foreman.
Presses: Compression, 13—9 ton, 2—13 ton, 6—18 ton, 2—24 ton.

ALDRICH PUMP COMPANY
Allentown, Pennsylvania
Personnel: A. B. G. Steel, pres.; A. H. Fisher, vice-pres. & treas.; R. J. Kuntz, secy.; G. D. Ruhe, gen. mgr.; L. T. Borneman, sales mgr.; L. W. Shelly, chief engr.; R. D. Thomas, plant mgr.; G. L. Baumgartner, pur. agent.

ALEKS, VYTANT
805 Highview Avenue
Rockford, Illinois

ALEXANDER, JEROME
50 East 41st Street
New York 17, New York

ALGERLEY LABORATORIES
Temple, Pennsylvania
Personnel: E. W. Gockley, owner, Norma Gernert, secy.; Richard G. Trafforal, sales mgr.; Raymond Baney, chief engr.; Richard G. Annarell, adv. mgr.

ALGONQUIN PARTS, INC.
Bridgeport, Connecticut

ALGOREN, LIONEL C.
620 North Michigan Avenue
Chicago 11, Illinois
Personnel: Lionel C. Algoren, owner.

ALL AMERICAN AIRCRAFT PRODUCTS, INC.
1350 East Anaheim Street
Long Beach 4, California

ALL MAKERS, INCORPORATED
27 Mechanic Street
Buffalo 2, New York

ALL METAL SCREW PRODUCT
Plastic Division
33 Greene Street
New York, New York
Branch Office: 53 Crosby St., N. Y.
Personnel: Nat Epstein, pres.; Jack Epstein, Perry Epstein & Irving Epstain, vice-pres.; Robert M. Joffe, plant mgr.
Presses: Compression, 4—50 ton, 1—125 ton, 1—150 ton; Injection, 1—2 oz.

ALL PLASTIC MFG. COMPANY
1159 South Broadway
Los Angeles, California

ALL PLASTICS, INC.
140 Cedar St.
New York 6, New York
Personnel: A. G. Tompkins, pres.; Walter Wagner, vice-pres.; W. B. Tompkins, secy.; T. P. Heider, vice-pres.; H. Wethling, treas.; Arthur W. Cadigan, supt.

ALKYDOL LABORATORIES, INC.
3242 South 50th Avenue
Cicero 50, Illinois
Personnel: Dr. Adolph Heck, pres. & treas.; A. Heck, vice-pres.; R. H. Cameron, secy.; Gene Stewart, supt.; W. C. Cody, chief chemist; J. E. Tatton, pur. agent.

ALLANSON ARMATURE MFG.
21 McCaul Street
Toronto, Ontario, Canada

ALLEGHENY LUDLUM STEEL
Brackenridge, Pennsylvania
Branch Offices: All principal cities.
Personnel: H. G. Batcheller, pres.; W. A. Givens, exec. vice-pres.; R. M. Allen, vice-pres. in charge of sales; F. B. Lonnsberry, vice-pres. in charge of mfg.; E. J. Hanley, secy. & treas.; E. L. Huff, chief engr.; C. B. Templeton, adv. mgr.; L. H. Bittner, pur. agent.

ALLEN, ELLIOTT A.
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Los Angeles 27, California

ALLIED ASPHALT & MINERAL
217 Broadway
New York 7, New York
Plant: South Second Ave., Dunellen New Jersey.
Personnel: F. M. Lea, pres.; George J. O'Sullivan vice-pres., treas. & gen. mgr.; J. Immel, asst. secy.; D. D. Downes, sales mgr.; S. C. Robison, dir. tech.

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ALLIED ENGRAVERS, INC.
100 Worth Street
New York, New York

ALLIED PLASTICS CORP.
6235 South Manhattan Place
Los Angeles, California

ALLIED PRODUCTS CORP.
4626 Lawton Avenue
Detroit 8, Michigan
Personnal: Ralph Hubbart, pres.; W. E. Ray, vice-pres.

ALLIS-CHALMERS MFG. CO.
Milwaukee 1, Wisconsin
Branch Offices: All principal cities.
Personnal: Waltar Geist, pres.; Edwin H. Brown, vice-pres. in charge of engr. div.; Wm. C. Johnson, vice-pres. in charge of sales & engr.; James M. White, vice-pres. in charge of mfg.; J. A. Keogh, vice-pres. & comptroller; H. W. Story, vice-pres. & gen. atty.; W. A. Roberts, vice-pres. in charge of tractor div.; W. E. Hawkinson, secy. & treas.; John T. Jarman, chief chem.; A. R. Tofte, adv. mgr. & dir. of pub. rel.; Fred E. Haker, pur. agent.

ALLITE MFG. COMPANY
5732 Duarte Street
Los Angeles 11, California
Personnel: Wm. Schrader, partner & gen. mgr.; Herman Pornar, partner; Albert Geissbuehler, supt.; Tom B. Linton, chief engr.

ALMAC PLASTICS, INC.
230 Fifth Avenue
New York, New York
Branch Office: 322 E. 23rd St., N. Y.
Personnal: Max J. Lewis, pres.; S. H. Ginsberg, secy. & treas.

ALUMINUM COMPANY OF AMERICA
801 Gulf Building
Pittsburgh 19, Pennsylvania

AMARON MFG. CORP.
601 South Anderson Street
Los Angeles 23, California
Personnel: George R. Cannon, pres. & gen. mgr.; H. Harley Cannon, vice-pres.; Guy C. Wilson Jr., secy. & treas.; William K. Haines, plant mgr.

AMATOY CORPORATION
140 South Dearborn Street
Chicago 3, Illinois
Branch Office: 15 E. 26th St., New York.
Personnel: Charles E. Russell, pres.; J. E. Gilchrist, vice-pres.; M. Gerwin, secy. & treas.; E. Poynter, adv. mgr.

AMECCO CHEMICALS, INC.
60 East 42nd Street
New York 17, New York
Branch Office: 75 Rockwood St., Rochester, N.Y.
Personnel: S. J. Cohen, pres., gen. & plant mgr.; W. E. Scheer, vice-pres., sales mgr. & dir. plastics resaarch; R. T. Heilpern, vice-pres.; J. G. Cohen, vice-pres.; K. G. Maurer, secy.

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American Pipe & Construction Co.
P.O. Box 342B
Terminal Annex
Los Angeles 54, California
Branch Office: 4554 N. Broadway, Chicago.
Personnel: Wm. A. Johnson, pres.; E. F. Bant, H. H. Jenkins, D. A. Dunkle & R. V. Edwards, vice-pres.; G. Crawford, treas.; C. G. Munger, chief chemist; G. L. Bursk, pur. agent.

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AMERICAN BRAKEBLOK DIV.
American Brake Shoe Company
4600 Merritt Avenue
Detroit 9, Michigan
Branch Offices: Chicago; Los Angeles; New York
Personnel: W. A. Bluma, pres. & gen. mgr.; W. R. Deway, vice-pres.; R. E. Spokes, vice-pres. & dir. plastics research; A. J. Brueggen, vice-pres.; M. B. Terry, sales mgr.; E. C. Keller, chief chem.; C. O. Smith, adv. mgr.; G. Wright, plant mgr.; Francis Smith supt.; F. Taylor, chief engr.; G. Mau pur. agent.

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American Metal Hose Branch
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Branch Offices: 1326 W. Washington Blvd., Chicago; 2906 Chester Ave. Cleveland; 25 Broadway, New York.
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Plant: West Haverstraw, N.Y.
Personnel: J. T. Ames, pres.; G. W Dyne, vice-pres.; W. P. Bitler, plan mgr.

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Bridgeport 2, Connecticut
Sales Office: A. P. Hall, 230 Park Ave New York.
Personnel: E. V. Creagh, adv. mgr. David Fleming, pur. agent.

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Plastics Division
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New York 20, New York
Personnel: C. J. Romieux, sales mgr.

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Calco Chemical Division
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rtland, Oregon

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icago, Illinois

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icago, Illinois

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Genesee Street
w Hartford, New York

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iladelphia 25, Pennsylvania
nch Offices: All principal cities.
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Presses: Extrusion: 2. Injection: 2—8 oz.

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New York 17, New York

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30 Rockefeller Plaza
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San Francisco 2, California
Personnel: Henry Vowinkel, owner.

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Mishawaka, Indiana
Personnel: Otto A. Pfaff, pres. & gen. mgr.; Harold Miller, treas.; R. Sherrard Elliot, secy.; David C. Turnbull, chief engr.; Stanley Kerezewski, supt.; John Starub, dir. research; L. L. Andrus, sales mgr.; A. E. Lenhart, adv. mgr. & dir. pub. rel.; Harold Books, pur. agent.

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Personnel: A. W. Machlet, pres. & treas.; P. C. Osterman, vice-pres. & secy.

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Personnel: W. H. Reynolds & L. Freeman, partners; P. H. Carlson, sales mgr.; L. Boor, dir. plastics research; C. L. Schuettler adv. mgr.; E. Madgin, pur. agent.

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Battle Creek, Michigan

AMERICAN MAT CORP.
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Toledo, Ohio
Personnel: E. M. Belknap, pres.; D. W. Moor Jr., secy., treas. & adv. mgr.

AMERICAN MOLDED PRODUCTS CO.
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AMERICAN MOLDING CO.
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San Francisco 5, California
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Presses: Compression, 30—10 to 350 ton; Extrusion, 1—2½ in.; Injection, 5—2½ to 16 oz.

AMERICAN MOLDING POWDER & CHEMICAL CORP.
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Personnal: Arthur J. Schmitt, pres. & gen. sales mgr.; Carl V. Widner Jr., vice-pres. & secy.; Albert Dushek, treas.; Carl A. Raabe, mgr. synthetic div.; H. Z. Benton, chief research engr.; Ben. Boldt, adv. & sales prom. mgr.; Andrew M. Pien, pur. agent; Wm. Rons, sales mgr.; Frank M. Vondrasek, export mgr.

AMERICAN PLASTICS CORP.
225 West 34th Street
New York 1, New York

AMERICAN PLASTICS ENGINEERING CORPORATION
414 Curtis Building
Detroit 2, Michigan

Personnel: Carl E. Holmes, pres. & owner; F. J. Holmes, vice-pres., secy. & treas.; John A. Koons, gen. mgr. & chief engr.; Chas. H. Frantz, consultant.

Presses: Injection, 1—4 oz., 1—6 oz., 1—9 oz.

AMERICAN PLASTIC MFG. CO.
2938 North Halsted Street
Chicago 14, Illinois

Personnel: Robert Kagan, pres., treas., adv. mgr. & pur. agent; Wayne King, vice-pres.; E. Gnimenti, secy.; L. Cordova, gen. mgr.; A. Lantz, supt. & plant mgr.

Pressas: Compression, 1—200 ton, 2—300 ton; Injection, 2—2 oz.

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Los Angeles, California

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Newark 5, New Jersey

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ttleboro, Massachusetts

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Clearing Station
Chicago 38, Illinois
Personnel: H. O. Schuessler, gen. mgr. & vice-pres.

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New York 1, New York
Personnel: Robert Appel, partner; Abraham Buchalter, pur. agent.

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275 Marguerita Lane
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Personnel: Robert J. Clay, owner.

RCO METALCRAFT, INC.
395 Brook Avenue
Bronx 54, New York

ARCO PLASTIC PRODUCTS CO.
33 West 60th Street
New York, New York

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42-16 Vernon Boulevard
Long Island 1, New York
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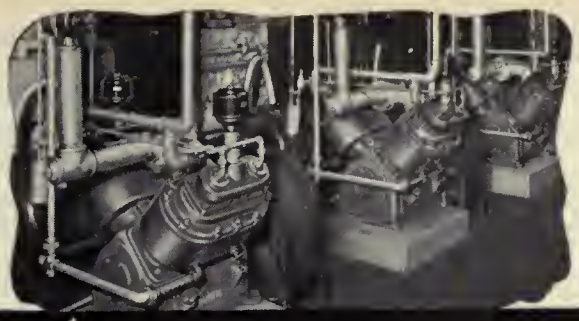

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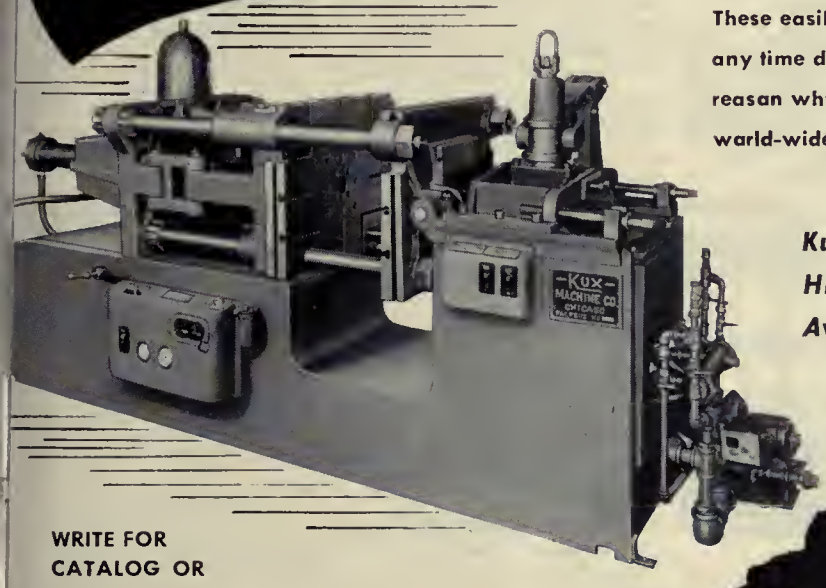

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Chicago 11, Illinois
Personnel: J. O. Reinecke and J. F. Barnes, partners; J. J. Wetzler, chief engr.; Ernest Forst, dir. plastics research; R. T. Fisher, dir. pub. rel.; A. C. Weiss, special consultant; N. J. Sax, pur. agent.

BARNES, RALPH, MOULDED PLASTICS
6518 Avalon Boulevard
Los Angeles 3, California

BARNES, W. O., COMPANY
1257 Terminal Avenue
Detroit, Michigan

BARNETT, INC., PLASTICS
316-101 Marietta St. Bldg.
Atlanta, Georgia
Personnel: J. W. Barnett, pres., gen. & sales mgr.; R. A. Fernandez, vice-pres. & export mgr.; Mrs. Daniel R. Allerton, secy.; T. B. McLaod, treas.; Daniel R. Allerton, chief engr. & chief chemist.

BARON STEEL COMPANY
4075 Detroit Avenue
Toledo, Ohio
Personnel: J. I. Baron, pres.; I. A. Higgins, sales mgr.

BARRETT DIVISION, THE
Allied Chemical & Dye Corp.
40 Rector Street, N.Y., N.Y.
Personnel: E. J. Elliott, asst. secy.; G. H. Glaason, div. mgr.; L. W. Miller, sales mgr.; E. C. Osborn, plant mgr.; A. G. Husen, adv. mgr.; S. P. Miller, dir. pub. rel.; L. G. Lawrence, pur. agent.

BARRETT, LEON J. COMPANY
P.O. Box 378
Worcester 1, Massachusetts
Personnel: Leon J. Barrett, pres.; Dwight C. Page, vice-pres.; Howard S. Foster, chief engr.; Leslie E. Clark, pur. agent.

BARRINGHAM RUBBER CO.
Reynolds Street North
Oakville, Ontario
Personnel: E. Barringham, pres. & gen. mgr.; M. O. Haskell, vice-pres.; C. M. Barringham, secy. & treas.; G. R. Bellinger, sales mgr.; G. Bastedo, supt. & plant mgr.; J. Roda, chief engr.; A. Hart, Chief chem.; G. R. Bellinger, adv. mgr.; B. Smillie, pur. agent; W. Scade, prod. mgr.
Presses: Compression, 1—200 ton.

BARRON, J. E. & ASSOCIATES
534 Vine Street
Cincinnati 2, Ohio
Personnal: J. E. Barron, owner.

BARROW-AGEE LABS.
121 South Front Street
Memphis, Tennessee
Branches: Cairo, Ill.; Chattanooga; Jackson, Miss.; Laland, Miss.; Nashville; Opalausas, La.; Shraveport.

BARSKY & STRAUSS, INC.
202 East 44th Street
New York 17, New York
Personnal: George Barsky, pres.; Frank A. Strauss, vice-pres., secy. & treas.

BARTLET ENGINEERING SERVICE
317 S. Madison Street
Rockford, Illinois
Personnel: Harold Bartelt & Donald Bartelt, partners; Harold Larson, chief engr.

BARTOLUCCI-WALDHEIM
1014 S. Michigan Avenue
Chicago 5, Illinois
Personnel: Edgar O. Bartolucci & J. B. Waldhaim, partners.

BARWOOD PRODUCTS CO.
4757 N. Ravenswood Avenue
Chicago 40, Illinois
Personnel: Gordon H. Gibbs, pres.; Edward L. Gibbs, vice-pres.; D. Y. Erickson, secy.

BASTIAN-BLESSING CO., THE
4201 West Peterson Avenue
Chicago 30, Illinois

BASTIAN BROS. CO.
1600 Clinton Avenue, North
Rochester, New York

BATES, P. D., CO., LIMITED
Ridgetown, Ontario, Canada

BATTALEN, L. H.
682 Broadway
New York, New York

BATTELLE MEMORIAL INSTITUTE
505 King Avenue
Columbus 1, Ohio
Personnal: Clyde Williams, dir.; Dr. F. C. Croxton, supvr. organic research div.; R. O. Stith, dir. pub. rel.; W. A. Welcker, pur. agent.

BAUM, A. J.
919 North Fifth Street
Sheboygan, Wisconsin

BAUMAN, MORTON A. & ASSOCIATES
214 Chester 12th Building
Cleveland 14, Ohio
Personnal: Morton A. Bauman, owner; Earl M. Bauman & Henry F. Menna, engrs.

BAUSCH & LOMB OPTICAL CO.
Rochester, New York

BAVERSTOCK & PAYNE
552 South Figueroa Street
Los Angeles, California

BAWDEN MACHINE CO.
163 Sterling Road
Toronto, Ontario, Canada

BAXMANN, CHARLES G. W.
2991 Garland Avenue
Detroit 14, Michigan

BAY STATE ABRASIVE PRODUCTS COMPANY
Union Street
Westboro, Massachusetts

BAY STATE TAP AND DIE CO.
Mansfield, Massachusetts
Branch Office: 9 S. Clinton St., Chicago.
Personnel: Louis A. Lincoln, pres., sales mgr. & adv. mgr.; F. S. Shepard, secy., treas. & gen. mgr.; H. L. Martin, supt., plant mgr. & chief engr.; E. A. L. Baron, pur. agent.

BEACH MANUFACTURING CO.
Montrose, Pennsylvania
Personnal: G. R. McKeage, pres. & gen. mgr.; John F. McKeage, vice-pres. & treas.; M. H. Baker, secy.; J. O. Horton, supt.; J. A. McKeage, chief engr.; H. W. Bateson, pur. agent.

BEACON BOX CO.
440 Natoma
San Francisco, Cal.

BEACON COMPANY, THE
91 Bickford Street
Boston, Massachusetts

BEACON INDUSTRIAL ENGINEERING SERVICE
60 East 42nd Street
New York 17, New York

BEAD CHAIN MFG. CO.
110 Mt. Grove Street
Bridgeport 5, Connecticut
Personnel: W. G. Bryant, pres., gen. mgr. & pur. agent; W. D. Blatz, vice-pres. & sales mgr.; David S. Day, secy.; M. H. Doolittle, treas.; L. F. Hall, supt.; G. F. Bahr, sales engr.

BEAMAN MOLDED PRODUCTS
2315 Southwest First Avenue
Portland 1, Oregon
Personnel: T. E. Baaman, owner & supt.; J. C. Da Shazor Jr., chief engr.
Presses: Compression, 1—50 ton, 1—100 ton, 1—300 ton.

BEATTY, BROOK PLASTICS
214 West 75th Street
Kansas City 5, Missouri
Personnel: Brook Beatty, owner & pur. agent; N. L. Beatty, secy.; H. J. Griffith, supt.

BEATTY MANUFACTURING CO.
118 East 25th Street
New York, New York

BECK, I. & SONS, INC.
353 East 20th Street
New York 3, New York
Personnel: I. Beck, pres.; Charles Beck secy. & gen. mgr.; Sigmund Beck plant mgr.; Charles Beck, pur. agent.

BECKER, MOORE & CO., INC.
North Tonawanda, New York
Personnal: Percy Bowen, pres. & treas. A. S. Bowen, vice-pres., secy. & pur. agent.

BEEBE BROS., INCORPORATED
2724 Sixth Avenue, South
Seattle 4, Washington

BEECHEM LABORATORIES
608 South Dearborn Street
Chicago, Illinois

BEHR-MANNING CORP.
P.O. Drawer 808
Troy, New York
Branch Offices: Boston; Buffalo, N. Y. Chicago; Cincinnati; Cleveland; Detroit; Grand Rapids, Mich.; High Point, N. C.; Indianapolis; Los Angelas; New York; Philadelphia; Pittsburgh; St. Louis; San Francisco; Tacoma, Wash.
Personnel: F. E. Gallagher, pres.; H. M. Elliot, vice-pres. & sales mgr.; A. J. Sidford & E. C. Schacht, vice-pres. M. E. Pesnal, secy.; J. O. Amstutz chief engr.; E. Chamberlain, ad mgr.; S. A. Barr, pur. agent.

BEL-AIR CREATIONS
539 North Fairfax Avenue
Los Angeles, California
Branch Office: 5547 Cleon Ave., N. Hollywood.
Personnal: Barnard Kotzin, managing partner; Arthur Adair, partner & sales mgr.
Presses: Injection, 1—8 oz., 2—12 oz.

BELDEN MANUFACTURING CO.
4647 West Van Buren Street
Chicago 44, Illinois

BELKE MFG. CO.
947 North Cicero Avenue
Chicago 5, Illinois

BELL AND BELTZ
3340 North Broad Street
Philadelphia, Pennsylvania

BELLANTINES INDUSTRIAL DESIGNERS
375 E. Fordham Rd.
New York, New York

BELLOWS CO., THE
861 E. Tallmadge Avenue
Akron, Ohio
Personnal: L. F. R. Bellows, pres.; H. B. Link, vice-pres. & gen. mgr.; Howard E. Mills, sales mgr.; N. E. Garett, pur. agent.

BELMONT PLASTICS COMPANY
8021 Melrose Avenue
Los Angeles 46, California
Personnal: Mack Teachar, partner, supt & dir. plastics research; Belmont, partner & sales mgr.; Lloyd Davies, pur. agent.

BELMONT RADIO CORP.
5921 West Dickens Street
Chicago 39, Illinois

BEN-ART NOVELTY CO., INC.
33-56 Fifty-fourth Street
Long Island, New York
Personnel: Benjamin Schur, pres.; Arthur Mansfield, vice-pres., secy. & treas.
Presses: Injection, 1—8 oz.

ID-A-LITE PLASTICS DIV.
4 South Honore Street
Chicago 12, Illinois
Personnel: Albert E. McKee, pres.; K. Comstock, vice-pres. & treas.; A. McKee, secy.; Roy C. Miller, chief ...; Fred W. Beersch, pur. egent.

NDINER & SCHLESINGER LABORATORY
Avenue & Tenth Street
w York, New York

NDIX CHEMICAL CORP.
Lexington Avenue
w York 17, New York

NNETTS' CHEMICAL LAB.
1 Market Street
loma, Washington

NTEK COMPANY
3 Atlantic Avenue
Brooklyn, New York
Branch Office: 19 W. 44 St., New York.
Personnel: Benjamin B. Kaplan, owner.

RGWOOD MOLDING CO.
West Sixth Street
nsas City, Missouri

RKANDER, GEORGE F., INC.
Broad Street
vidence 7, Rhode Island
Personnel: Harry N. Berkander, pres.; ar L. Heltzen, secy.; Hector A. man, treas.; John S. Moran, gen. r.; Albert H. Hanson, supt.; Edward Money, chief engr.
Presses: Injection, 1—1½ oz., 1—2 oz., 4 oz.

RKELEY ENGINEERING & MANUFACTURING CO.
rkeley Heights, New Jersey
Personnel: Alfred F. Bahlke, partner upt.; William Giese, partner & chief gr.
Presses: Compression, 2—50 ton, 1—75 , 1—150 ton; Injection, 1—6 oz., 1— z.

RNHARD, LUCIAN
East 53rd Street
w York 22, New York
Personnel: Lucian Bernhard, owner; H Bernhard, asst.

RRY TOOL & MACHINE CO.
e, Pennsylvania

RST-FOSTER-DIXFIELD CO.
ttsburg, New York

RYLLIUM CORPORATION OF PENNSYLVANIA
ading, Pennsylvania
Personnel: J. S. Gravely, pres.; R. M. imby, secy.; A. Berger, treas.; L. F. land, salesmgr.; D. Wilkie, supt.; H. Kawecki, chief chem.; N. E. Morri- , personnel; J. W. Beazlie, pur. ent.

ETILITE COMPANY, INC.
7 Main Street
lleville 9, New Jersey
Personnel: Thomas Fortino, pres., secy. gen. mgr.; Robert de Crescenzo, ce-pres., sales & plant mgr.

ETTER FABRICS TESTING BUREAU, INC.
1 West Thirty-first Street
ew York, New York

ETTER FINISHES AND COATINGS, INC.
98-276 Doremus Avenue
ewark 5, New Jersey
Personnel: A. R. Forgie, J. A. Carle, C. Tappen & M. C. Bryant, owners.

ETZ, W. H. & L. D.
illingham and Worth Streets,
Frankford
hiladelphia, Pennsylvania

EUTEX CORPORATION
75 New Brunswick Avenue
erth Amboy, New Jersey
Personnel: Frank J. Clarey, pres., gen. sales mgr., dir. plastics reseerch & pur. agent; Martin F. Desmond, asst. secy., asst. trees. & pur. agent; L. Gerard O'Brien, dir. pub. rel.

BEVIL CO.
1801 South Soto Street
Los Angeles 23, California

BICKNELL-THOMAS CO.
90 Wells Street
Greenfield, Massachusetts

BIENEN-DAVIS, INC.
159 Madison Avenue
New York, New York

BIGGS BOILER WORKS CO.
1007 Bank Street
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Branch Offices: Cleveland; Detroit; New York; Philadelphia; Toledo
Personnel: B. R. Barder, pres. & gen. mgr.; F. G. Sherbondy, vice-pres., treas. & sales mgr.; L. M. Wise, secy.; W. H. Hawk, chief engr.; R. Sweeny, pur. agent.

BILLINGS & SPENCER CO., THE
1 Laurel Street
Hartford 6, Connecticut

BINGHAMTON FLEXIBLE SHAFT DIVISION
Swarts & White Mfg. Co.
215 Washington Court
Binghamton, New York

BINKS MANUFACTURING CO.
3114-40 Carroll Avenue
Chicago 12, Illinois

BINNEY & SMITH CO.
41 East 42nd St., N.Y., N.Y.
Branch Offices: Boston, Chicago, Montreal, Philadelphia.
Personnel: A. F. Kitchel, pres.; N. L. Smith & John Stead, vice-pres.; F. R. Cantzlaer, sec. & treas.; F. A. Bonstedt, sales mgr.; D. F. Cranor, chief chem.; J. M. Hamilton, adv. mgr.

BIRD & SON, INC.
1934 E. Clark Street
East Walpole, Mass.

BIRDSBORO STEEL FOUNDRY & MACHINE COMPANY
Birdsboro, Pennsylvania

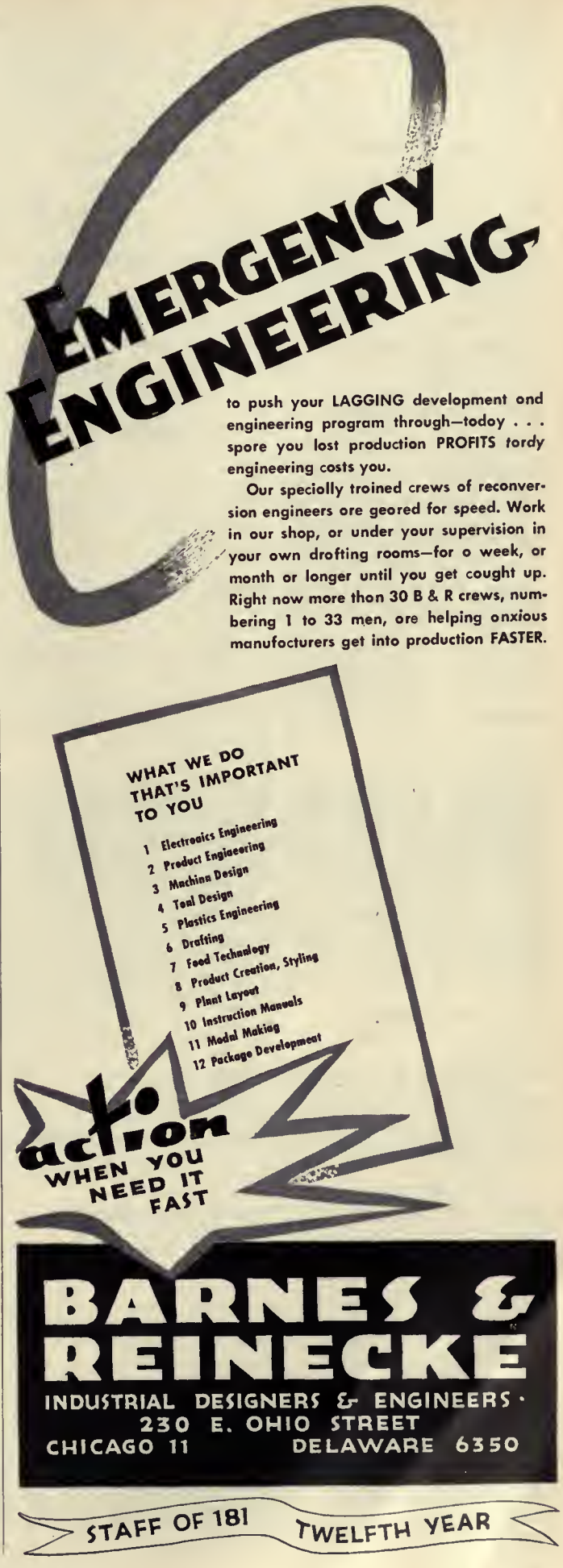
BISCHOFF, ERNST CO., INC.
50 East 42nd Street
New York 17, New York
Branch Offices: 301 Walnut Street, Memphis 5, Tennessee.
Personnel: I. M. Bischoff, pres.; H. G. Terwilliger, exec. vice-pres.; Carl Truebe, vice-pres.; C. Bischoff Terwilliger, secy.; H. G. Terwilliger, treas.; J. J. Borghi Jr., plant mgr. Dr. James M. Church, consulting chem.

BJORKSTEN LABORATORIES
185 North Wabash Avenue
Chicago, Illinois
Branch Office: 13791 S. Avenue "O", Chicago.
Personnel: Dr. J. Bjorksten, owner & gen. mgr.; Stuart O. Fiedler, vice-pres.; F. B. Korsgard, secy.; Dr. Wm. I. Harber, sen. organic chem.

BLACK & DECKER MFG. CO.
Towson 4, Maryland
Personnel: S. Duncan Bleck, pres.; Alonzo G. Decker, vice-pres. & gen. mgr.; Robert D. Black, vice-pres. & sales mgr.; A. G. Decker Jr., vice-pres. charge mfg.; Chas. A. Sacro, secy.; Frenk J. Nagell, treas.; John M. Fox, supt.; Glenn C. Wilhide, chief engr.; J. F. Apsey Jr., adv. mgr.; Ches. B. Mann, pur. agent.

BLAISDELL PENCIL CO.
141 Berkeley Street
Philadelphia 44, Pennsylvania

BLANCHARD MACHINE CO.
64 State Street
Cambridge 39, Massachusetts
Personnel: H. K. Spencer, secy., treas. & gen. mgr.; D. R. Weedon, sales mgr.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STAFF OF 181 TWELFTH YEAR

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Personnel: John Blank & A. E. Buxton, partners.

BLAW-KNOX COMPANY
Farmers Bank Bldg.
Pittsburgh, Pennsylvania
Branch Offices: Birmingham; Chicago; New York; Philadelphia; Washington.
Personnel: W. P. Witherow, pres.; L. E. Joseph, vice-pres. charge Blaw-Knox Division; E. W. Forker, charge Process Equipment; Frederick Baker, treas.; Arne Olson, chief engr. proc. aquip. dept.; A. E. Hohman, adv. mgr.; D. Clinton Grove, dir. pub. rel.; J. E. McWilliams, pur. agent Blaw-Knox Div.

BLESSING, GREGORY, ASSOC.
630 Fifth Avenue
New York, New York

BLISS, E. W. COMPANY
53rd Street & 1st Avenue
Brooklyn, New York
Branch Offices: 176 Federal St., Boston; 919 N. Michigan Ave., Chicago; 815 Superior Ave. N.E. & Euclid, Cleveland; W. Grand Blvd. & 2nd Ave., Detroit; 1004 E. State St., Hastings, Mich.; 129 Church St., New Haven, Conn.; 18 W. Chelton Ave., Philadelphia; 65 Broad St., Rochester; 250 Franklin St., Salam, Ohio; 1420 Hastings St., Toledo; 159 Bay St., Toronto.
Representative: Moore Machinery Co., 3876 Santa Fe Ave., Los Angeles & 1699 Van Ness, San Francisco.
Personnel: D. S. Harder, pres.; E. S. McClary, secy. & treas.; A. Seidel, sales mgr.; G. J. Haan, plant mgr.; A. Schloz, chief engr.; John J. Feeley, adv. mgr.; F. B. Smith, pur. agent.

BLODGETT, G. S. CO., INC., THE
50 Lakeside Avenue
Burlington, Vermont
Sales Representatives: Charles A. Drum, 2117 Barbee St., Houston; Guy R. Kendall, 164 S. Central Ave., Los Angeles; D. J. Brogan, Grand Central Bldg., New York; W. W. Kapus, 1803 N.E. 12th Street, Portland, Oregon.
Personnel: Robert F. Patrick, treas.; Daniel J. Brogan, sales mgr.

BLUM, JULIUS & CO., INC.
532-540 West 22nd Street
New York 11, New York

BODDE, B. M.
9130 Exposition Drive
Los Angeles, California

BOICE-CRANE COMPANY
930 West Central Avenue
Toledo 6, Ohio
Export Offices: 218 N. Jefferson St., Chicago; 2 Lafayette St., New York.
Personnel: M. H. Buahrer, gen. & sales mgr.; J. R. Rettia, supt. & plant mgr.; J. H. Luken, pur. agent.

BOLTA COMPANY, THE
151 Canal Street
Lawrence, Massachusetts
Branch Office: Bolta Plastics Ltd., Vittie Street, Granby, Quebec.
Personnel: Ernest W. Halbach, pres.; John Bolten, ch. of bd.; Leo M. Trilling, vice-pres. & secy.; Harold T. Houston, treas.; James D. Casey, chief engr.

BOLTA PLASTICS LIMITED
Vittie Street
Granby, Quebec, Canada

BONWITT, DR. GUSTAVE L. LABORATORY
17 West 60th Street
New York 23, New York

BOOKOUT & HUTCHINS
9200 Exposition Boulevard
Los Angeles, California

BOONTON MOLDING CO.
Boonton, New Jersey
Branch Office: 122 E. 42nd St., New York.
Personnel: Geo. K. Scribner, pres.; Fred K. Davidson, vice-pres. & plant mgr.; H. L. Dixon, secy. & pur. agent; W. T. Helwage, treas.; Chris. J. Groos, sales mgr.; Ronold W. Post, customer angr.; Gordon Sayre, plant engr.
Pressas: Compression, 130—various capacitias; Injection, 1—1½ oz., 2—2 oz., 1—4 oz., 2—6 oz., 13—8 oz.

BOOTH, GARRETT & BLAIR
414 Locust Street
Philadelphia, Pennsylvania

BOOTS AIRCRAFT NUT CORP.
New Canaan, Connecticut

BORKLAND LABORATORIES
Sycamore Lake
Marion, Indiana
Branch Offices: 53 W. Jackson Blvd., Chicago.
Personnel: G. Walter Borkland, owner.

BORROWMAN, GEORGE
9 South Clinton Street
Chicago, Illinois

BORTMAN PLASTICS CO.
183 Essex Street
Boston, Massachusetts
Branch Offices: Chicago; Los Angeles; Montreal; New York; Toronto.
Personnel: Mark Bortman, pres. & gen. mgr.; C. S. Lintwieler Jr., secy.; E. B. Lintwieler, treas.; Herbert S. Bortman, sales mgr.; J. B. Hermson, chief chem.; L. V. Dulton, adv. mgr.

BOSTON PLASTIC MOLDING
791 Tremaine Street
Boston, Massachusetts
Personnel: Henry Freedman, partner & gen. mgr.; Edward E. Freedman, partner & chief cham.; Simon Freedman, plant mgr.
Presses: Compression, 10—50 ton.

BOULWARE BERRY ASSOCIATES
654 Madison Avenue
New York 21, New York

BOURKE & MABEE
Harbour Commission Building
Toronto, Ontario, Canada

BOWERS MACHINE SHOP
Woodbridge, New Jersey

BOWSER-MORNER TESTING LABORATORIES
141 Bruen St., Dayton, Ohio

BOYD, A. B. CO.
1235 Howard Street
San Francisco, California
Branch Offices: Dallas; Los Angeles; Portland, Seattle.
Personnel: E. J. Towle, owner; E. A. Lusch, gen. & sales mgr.; D. Desmond, supt.; W. A. Sherburne, dir. plastics research.

BOYKO, JOHN
10238 Beaconsfield
Detroit 24, Michigan

BRAND, WILLIAM & COMPANY
276 Fourth Avenue
New York 10, New York
Branch Office: Chicago.

BRANDENBURG, MELFORD F.
358 Fifth Avenue
New York 1, New York

BRANDENBURGER, RUSSELL E.
P.O. Box 341
Shelbyville, Indiana

BRANDT, JOS. & BRO., INC.
521 East 72nd Street
New York, New York
Personnel: Louis Brandt, pres., gen. mgr. & pur. agent; I. Engel, dir. pub. rel., sales & adv. mgr.

BRANDWELL SALES
40 East 19th Street
New York 3, New York
Personnel: Meyer Wellens, gen. mgr.; Dan Brandenstein, sales mgr.

BRANSTON ELECTRIC MFG. CO.
65 Gill Place
Buffalo 13, New York

BREUER ELECTRIC COMPANY
5100 N. Ravenswood Avenue
Chicago, Illinois
Personnel: C. A. Bremmar, sales mgr. & adv. mgr.; B. R. Breuer, pres. & treas.; J. P. Jason, vice-pres. & plant mgr.; G. W. Breuer, vice-pres. & gen. mgr.; B. B. Criswell, secy.; C. W. Lanter, chief engr.; I. Burton, pur. agent.

BREWER & GARDNER
Eighteenth and Cherry Sts.
Philadelphia, Pennsylvania

BREYER MOLDING COMPANY
2536 West Lake Street
Chicago 12, Illinois
Personnel: Bernard J. Smith, pres.; S. J. Stone, vice-pres.; Charles Schiff, secy. & treas.; Wm. A. Sherman, supt.
Presses: Compression, 15—50 to 300 tons; Injection, 1—9 oz., 1—16 oz.

BRIDGEPORT MOULDED PRODUCTS, INC.
300 Myrtle Avenue
Bridgeport, Connecticut
Branch Office: 105 Meadow St., Fairfield, Conn.
Personnel: James S. Berhold, pres. & salesmgr.; Ralph Hill, vice-pres., supt. & plant mgr.; Dan R. Neary, vice-pres.; D. Earl Fleming, secy.; Lancaster P. Clark Jr., treas. & gen. mgr.; James S. Berthold, sales mgr.; Edward A. Tyler, dir. pub. ral.; Albart J. Swadoda, pur. agent.
Presses: Compression, 53—18 to 452 tons; Injection, 15—2 to 12 oz.

BRIDGEPORT SAFETY EMERY WHEEL CO., INC., THE
1299 West Broad Street
Stratford, Conecticut
Personnel: John T. Kilbrida, pres. & gen. mgr.; Thomas H. Hovenden, vice-pres.; Charles A. Kenney, secy. & treas.; W. R. Brown, sales mgr.; Joseph Conlon, supt.; Myron Mischanski, chief chemist; D. McConaughy Jr., adv. mgr.; Hugo Schaeffer, dir. pub. rel.; A. Foito, pur. agent.

BRIDGEPORT TESTING LAB.
675 Knowlton Street
Bridgeport, Connecticut

BRIER MANUFACTURING CO.
222 Richmond Street
Providence 2, Rhode Island
Personnel: Benjamin Brier, pres.

BRIGHAM, R. B., COMPANY
327½ 16th Street
Toledo 2, Ohio

BRIGHT STAR BATTERY CO.
Clifton, New Jersey

BRILHART, ARNOLD LTD.
435 Middle Neck Road
Great Neck, New York
Personnel: Arnold Brilhart, pres. & treas.; Clark F. Galehouse, vica-pres., gen. mgr.; supt. & chief engr.; Verlye Mills Brilhart, secy.; J. Frank Vernon Jr., sales mgr.; Earl S. Edwards, chief chem.; Dudley Bancker, dir. pub. rel.; Harry Fabre, pur. agent.
Presses: Compression, 18—up to 80 tons; Injection, 8—up to 12 oz.

BRISTOL COMPANY, THE
Waterbury, Connecticut
Branch Offices: All principal cities.
Personnel: H. H. Bristol, pres.; L. G. Beane, vice-pres. charge engr. & sales; H. Koester, vice-pres. charge works; C. W. Bristol, vica-pres. & adv. engr.; S. R. Bristol, secy.; W. H. Faeth, traas.; H. E. Beane, sales mgr.; G. P. Lonergan, adv. mgr.; J. A. H. Peterson, dir. pub. rel.; W. J. Roemer, pur. agent.

BRISTOL COMPANY OF CANADA, LTD., THE
71-79 Duchess Street
Toronto, Ontario, Canada

BRITISH XYLONITE CO., CANADA, LTD.
60 Front St., W.
Toronto, Ontario, Canada

BROCKTON TOOL COMPANY
Central Street
South Easton, Massachusetts

BRODER INDUSTRIES, INC.
161-7 W. 64th Street
New York, New York
Personnel: Harry Broder, pres.; Sam Schwartzman, sales mgr.; J. P. Brecke- chief engr.; Laonard Broder, asst. pres.

BROEMAN, F. C. & CO.
Third and Walnut Streets
Cincinnati, Ohio

BROGAN, BYARD F.
805 Sansom Street
Philadelphia, Pennsylvania

BRONSON, F. E. COMPANY
64 Broad Street
Elizabeth 4, New Jersey
Branch Office: 1636 Irving Street, Rahway, N.J.
Personnel: F. E. Bronson, pres.; Charles Simola Sr., supt.; Charles J. Simola, chief engr.

BRONZART METALS COMPANY
220 Fifth Avenue
New York, New York

BROOKLYN PLASTIC COMPANY
78 Prince Street
Brooklyn, New York
Personnel: William Rubin, partner.

BROSITES MACHINE CO., INC.
50 Church Street
New York, New York
Personnel: G. H. Weber, pres.; Joseph L. Hutchings, vice-pres. & treas.

BROWN & SHARPE MFG. CO.
235 Promenade Street
Providence 1, Rhode Island

BROWN, DAVID C. COMPANY
175 32 Wisconsin
Detroit, Michigan

BROWN, E. NORRIS
15 Bradford Place
Brockton, Massachusetts

BROWN INSTRUMENT CO.
Wayne & Roberts Avenue
Philadelphia, Pennsylvania
Branch Offices: All principal cities.
Personnel: H. F. Dever, pres.; J. P. Goheen, secy. & treas.; L. M. Morle sales mgr.; M. B. Taft, plant mgr G. M. Muschamp, chief engr.; J. F Sullivan, adv. mgr.; N. E. Reisgen, di pub. rel.; J. W. Weingartner, pur agent.

BRUSH DEVELOPMENT CO., THE
3405 Perkins Avenue
Cleveland 14, Ohio

BRY, PAUL
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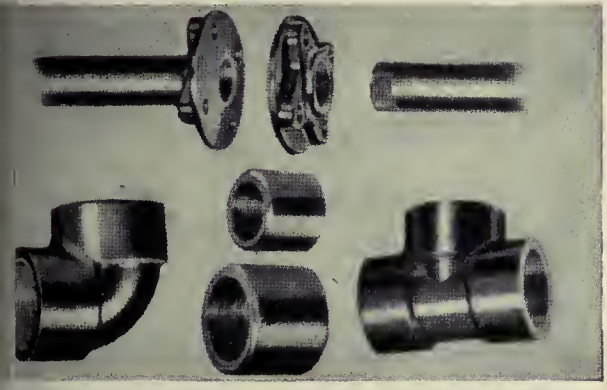

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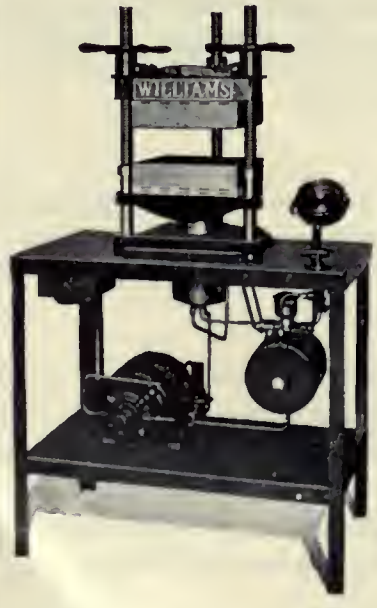

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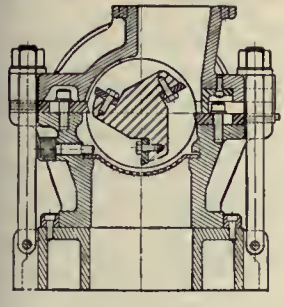

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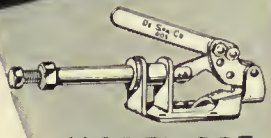

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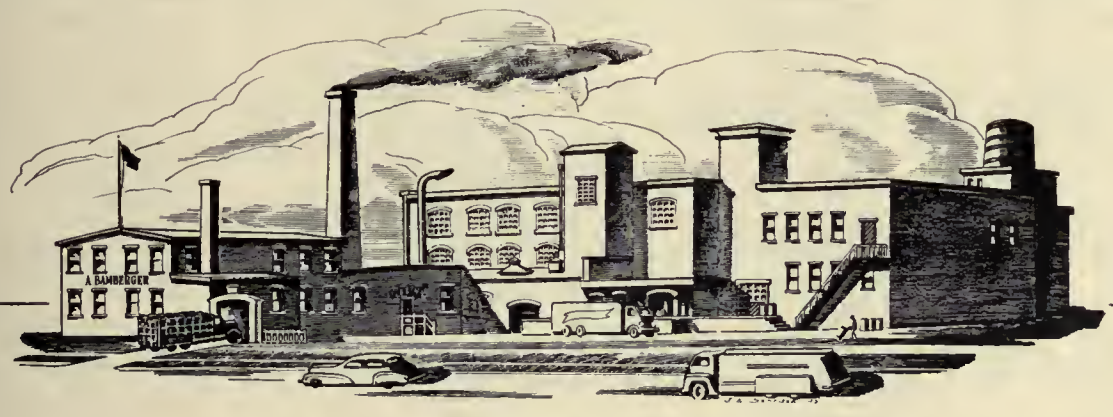

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Personnel: B. S. Lloyd, pres. & adv. mgr.; R. S. Lloyd, vice-pres., treas., gen. mgr. & dir. of plastics research; R. E. Husar, secy. & supt.; J. B. Abram, sales mgr.; J. Grant, chief engr.; A. Rodriguez, chief chem.; R. W. Reid, pur. agent.

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Presses: Compression, 5—150 ton, 4—200 ton, 1—300 ton.

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Moline, Illinois
Personnel: M. Porosky, pres. & gen. mgr.; E. F. Havey, sales mgr.; H. W. Anderson, supt.; E. R. Freeberg, chief engr.

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EASTERN MACHINE SCREW CORPORATION, THE
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New Haven 6, Connecticut
Personnel: C. W. Bettcher, pres.; L. K. Burwell, sec.; T. W. Ryley, treas.; E. O. Williamson, supt.

EASTERN PLASTICS, INC.
3000 Penn Avenue
Pittsburgh 1, Pennsylvania
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Presses: Compression, 1—20 ton, 1—30 ton, 1—85 ton, 1—100 ton, 1—200 ton, 1—250 ton; Compression & Transfer, 1—500 ton.

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Presses: Compression, 20—350 ton, 4—500 ton, 1—1000 ton, 3—2000 ton; 1—2 oz., 3—8 oz., 2—16 oz., 8—22 oz., 2—32 oz.

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Rochester 10, New York
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Personnel: Selden E. May, pres., Irene Schoffman, secy., Joseph Walczak, supt., N. C. Lowe & W. Leonard Mooney, sales engr.

ECONOMY ENGINEERING CO.
2653 W. Van Buren St.
Chicago, Illinois
Branch Offices: 342 Madison Ave., New York.
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Chicago 5, Illinois
Personnel: Dr. E. W. Lowe, pres.; Dr. W. S. Guthmann & Dr. W. B. Hendrey, vice-pres.; Raymond Lambert, adv. mgr.; Herman Kerst, pur. agent.

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Boston, Massachusetts

EHLERT, HAROLD H.
Franklin, Michigan

EKROTH LABORATORIES, INC.
60 Freeman Street
Brooklyn, New York

EKSTROM CARLSON & CO.
1439 Railroad Avenue
Rockford, Illinois
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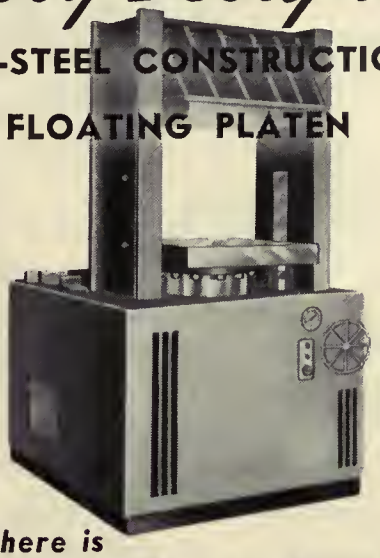

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New York 23, New York
Personnel: Max Emsig, Sidney Emsig, Jack Emsig & Joseph Sucher, partners.
Presses: Compression, 150 ton.

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Chicago, Illinois
Personnel: Albert K. Epstein, pres.; Benjamin R. Harris, vice-pres.; L. K. Epstein, secy.; E. S. Thayer, sales mgr.; R. H. Carr, chief engr.; Dr. H. I. Bernstein, chief chemist; C. Piowaty, supt.

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ERIE PLASTICS CO.
1304 Cranberry Street
P. O. Box 515
Erie, Pennsylvania
Personnel: Harold C. Sherk, Fran Gahn, N. C. Hyman, Thomas J. Mar Krell & John J. Lynch, partners.
Presses: Injection, 1—4 oz., 3—8 oz.

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644 W. 12th Street
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Personnel: G. Richard Fryling, pres. W. Henry Fryling, vice-pres. in charge of sales; B. B. Minnium, vice-pres. in charge of engr.; J. E. Dieteman, treas. J. M. Allen, gen. mgr.; Wm. C. Conroy, sales mgr. plastics; Allen K. Shenk, adv. mgr.; James G. Parks, dir. public relations, L. C. Camp, pur. agent.
Presses: Extrusion, 1—2½ in.; Injection 3—2 oz., 2—4 oz., 1—6 oz., 5—8 oz. 2—16 oz.

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New York 16, New York
Personnel: Ada Banks, pres.; Benj. Klieger, treas.; Saul I. Blakesberg, gen. mgr.; H. T. Banks, dir. plastics research & pur. agent.

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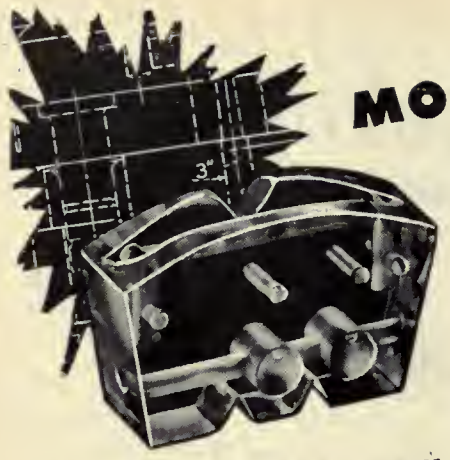

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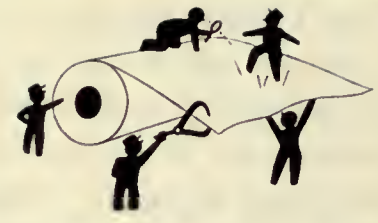

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GENERAL PLASTICS CO.
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160 West Burton Place
Chicago, Illinois

GLEICH, EMANUEL D.
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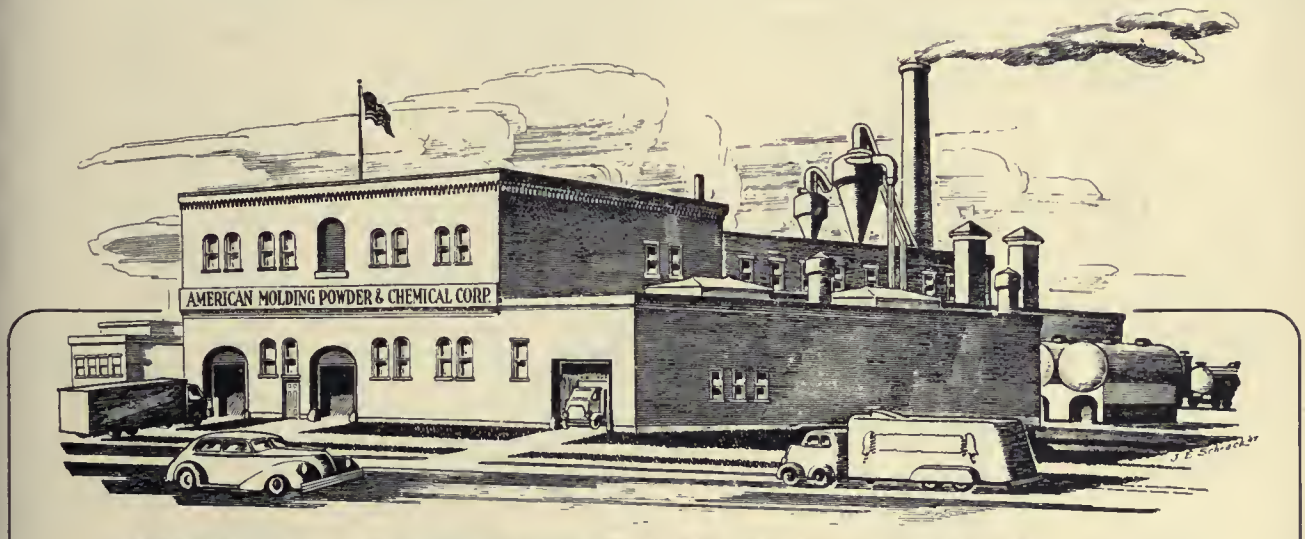

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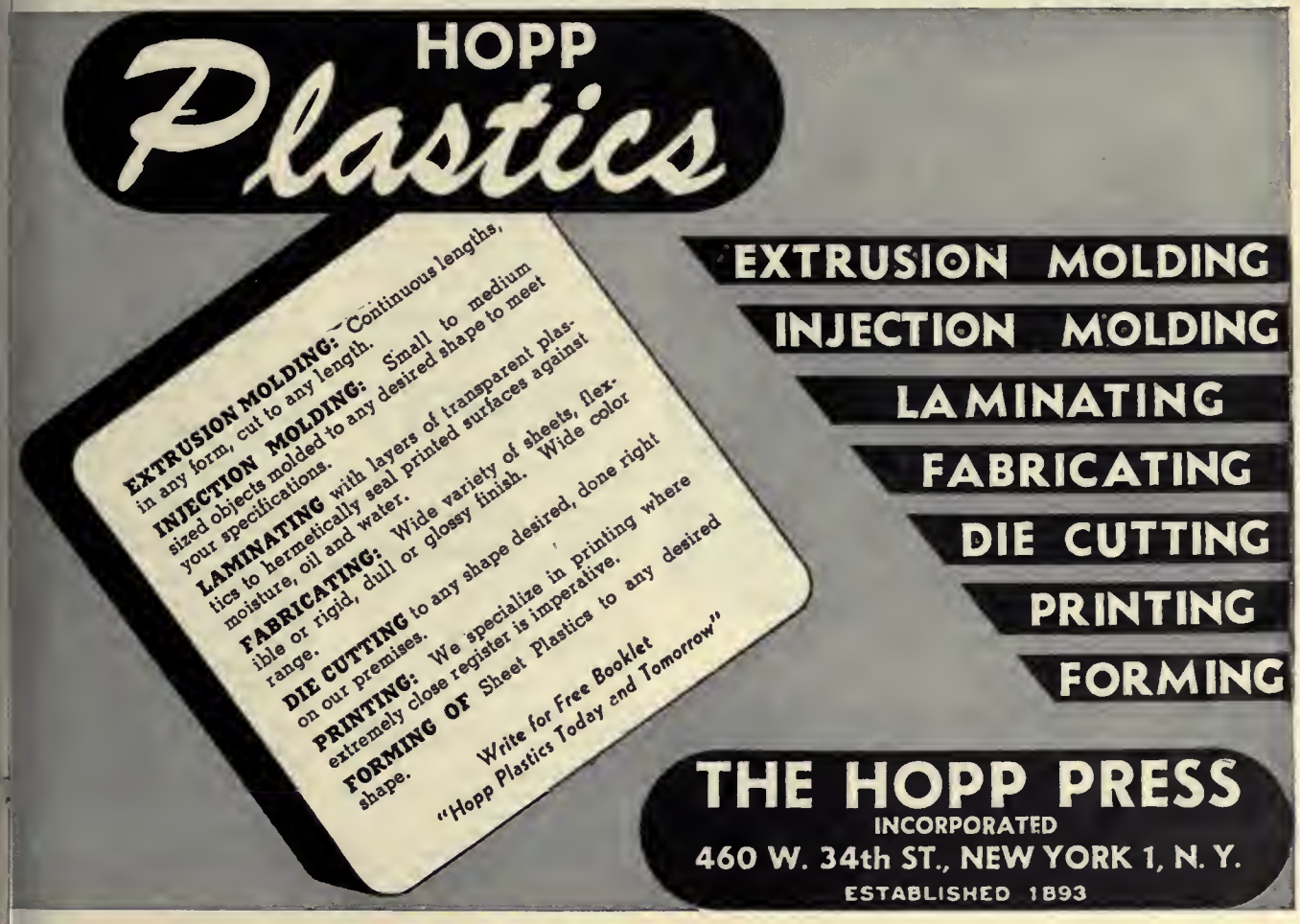
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Personnel: C. H. Armstrong, owner.

INDUSTRIAL MOLDED PRODUCTS COMPANY
2035 West Charleston Street
Chicago 47, Illinois
Personnel: Hugo S. Erickson, partner & gen. mgr.; Carl Benson, partner & chief engr.; C. E. Wright, supt.
Presses: Compression, 12—120 ton, 4—150 ton, 4—200 ton, 1—500 ton.

INDUSTRIAL OVEN ENG. CO.
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Cleveland 11, Ohio
Branch Office: 332 S. Michigan Ave., Chicago.
Personnel: C. A. Litzler, owner & gen. mgr.; Hubert Glatte, sales engr.; D. M. Wilkinson, chief engr.; Louis Beck, pur. agent.

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Montreal, Quebec, Canada

INDUSTRIAL PLASTICS
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New York 16, New York

INDUSTRIAL PLASTICS CORP.
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Gardena, California
Personnel: W. Brandt Goldsworthy, pres., plant mgr. & dir. plastics research; T. E. Thal, vice-pres., gen. & adv. mgr.; J. C. Kumler, secy., treas. & sales mgr.; Keith Schribner, chief chem. & engr.; George Covert, dir. pub. rel. & pur. agent.

INDUSTRIAL PLASTICS CORP.
206 Fairfield Road
Caldwell Township, New Jersey

INDUSTRIAL PLASTICS CORP.
435 North Second Street
Milwaukee 3, Wisconsin
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Presses: Compression, 50 to 250 ton; Extrusion, 1—2½ in.; Injection, 1—8 oz., 1—160 oz.

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Presses: Injection, 1—6 oz., 1—14 oz.

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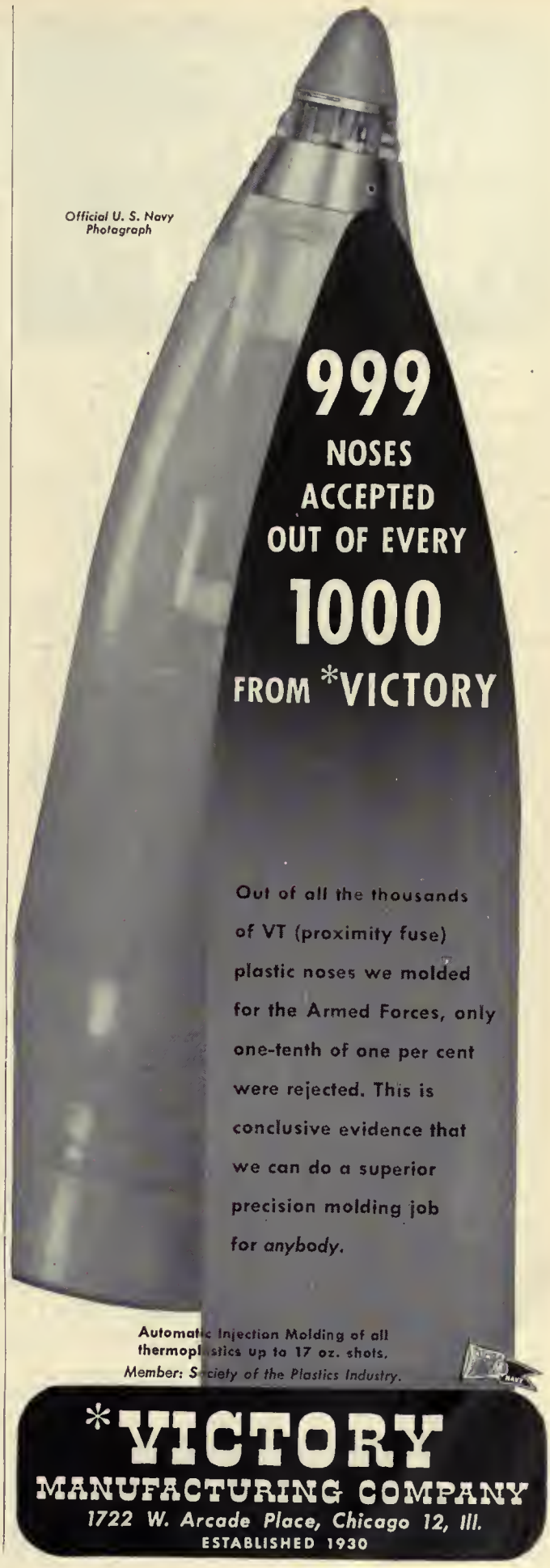
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Minimum shut height	4"
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Parsonnel: Leon Neuman, partner, gen. mgr. & pur. agant; S. Neuman, D. Sprung, partners; James Day, supt.; L. Winik, chief engr.

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San Francisco, Calif.

Branch Offices: American Bank Bldg., Portland, Ore.; Chamber of Commerce Bldg., Los Angeles.

Personnal: J. K. Benadict, owner; Peter Johnson, secy. & treas.; C. Martin Welch, gan., plant & sales mgr.; George Emanuels, supt.; H. D. Sherrill, chief engr.; Ellan Morgan, chief chem.; Virginia Duval, adv. mgr.

Presses: Compression, 2—20 ton, 20—50 ton, 2—300 ton; Extrusion, 1—2 in., 1—3 in.; Injection: 1—8 oz.

KENTON ENGINEERING
3510 Beals
Detroit, Michigan

KENT-OWEN MACHINE CO.
958 Wall Street
Toledo 10, Ohio

KENT STUDIOS SERVICE, INC.
385 Madison Ave.
New York, New York

KEOLYN PLASTICS
2731 North Pulaski Road
Chicago 39, Illinois

Personnal: W. L. McKay, managing partner; W. D. McKay, partner & sales mgr.; E. R. McKay, partner; P. J. Brueckner, supt.

Presses: Injection, 1—2 oz., 1—4 oz., 1—9 oz.

KERR, R. W. CO.
220-222 S. Burlington Ave.
Hastings, Nebraska

Personnal: R. W. Kerr, owner & gen. mgr.; Ed Lewellyn, sales mgr.; George Kahn, chief engr.

KESSLER CHEMICAL CO., INC.
State Road and Cottman Avenue
Philadelphia 35, Pennsylvania

Personnel: Fred E. Loud, pres.; L. W. Wasum, vice-pres.; J. Rodman Tompkins, secy.; David Levin, treas.; J. E. Stonis, sales mgr.; J. G. Shea, pur. agent.

KESTIN, M. J. CO.
225 LaFayette St.
New York 12, N.Y.

KETCHAM, HOWARD, INC.
101 Park Avenue
New York 17, New York

Personnel: Howard Ketcham, pres. treas.; Wm. McVaugh Jr., vice-pre W. Cole, secy.; Leon S. Theil, dir. pu rel.

KETT TOOL COMPANY, THE
5 East 3rd Street
Cincinnati 2, Ohio

KEYES FIBRE COMPANY
Upper College Avenue
Waterville, Maine

Personnal: D. S. Brigham, pres.; W. Parsons, vice-pres. & gen. mgr.; L. Pierce, secy.; Spaulding Bisbee, treas John M. Hart Co., Inc., New Yor sales mgr.; W. H. Randall, chief engr E. E. Sawyer, chief chemist; G. Johnson, mgr. of mfgr.

KEYSTONE BRASS WORKS, INC
944 West 12th Street
Erie, Pennsylvania

Personnal: M. Rowley, gen. mgr.

KEYSTONE MACHINE CORP.
25 Orange Ave.
Irvington, N. J.

Personnel: John Tkacz, pres.; Willia Tkacz, vice-pres.; Elizabeth Tkacz, sec & treas.

KEYSTONE PLASTIC ENGINEERING CO.
1313 West Randolph Street
Chicago 7, Illinois

KEYSTONE PLASTICS CO.
No. 3 South Princeton Avenue
Swarthmore, Del. Co., Pa.

Parsonnel: H. M. Fricke & R. F. Alexander, owners; Sydney Fort, supt.; E A. Armstrong, pur. agent.

KEYSTONE SPECIALTY CO.
1373½ Cove Avenue
Lakewood 7, Ohio

KIEMAC MFG. CO.
37-48 Sixty-first St.
Woodside, Long Island, New York

Parsonnel: Frank W. McDowell, partner, supt. & pur. agent; Paul Kienast partner & dir. plastics research; Geo Kienast, engr.; Danial Piuck, chie chem.

KILGORE MFG. COMPANY, THE
Westerville, Ohio

Personnel: H. B. Watkins, pres.; H. H Dooley, sales mgr.

Prasses: Injection, 1—1 oz., 1—2 oz. 2—4 oz., 1—7 oz., 2—9 oz.

KIMBERLY-CLARK CORP.
Neenah, Wisconsin

Branch Offices: 8 S. Michigan Ave Chicago; 122 E. 42nd St., New York 155 Sansoma St., San Francisco.

Personnel: Cola G. Parker, pres.; Erns Mahler, exec. vice-pres.; H. G. Boon W. H. Clifford, John R. Kimberly & C. H. Saga, vica-pres.; C. F. Jenkins sales mgr.; Lyall Stilp, pur. agent; W W. Cross, sales mgr. plastics div.

KIMBLE ELECTRIC DIVISION
Miehle Printing Press & Mfg. Co.
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Chicago, Illinois

KING, J. M. MFG. CO.
American and Diamond Streets
Philadelphia, Pennsylvania

KING PLASTICS CORP.
30 West 36th Street
New York 18, New York

Branch Office: 704 S. Spring St., Los Angeles.

Personnal: Adolph Vogel, pres.; Paarl Rosenblatt, vice-pres.; Harold Borg, secy. & treas.; Henry Vogel, gen. mgr.

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Denver 3, Colorado
Personnel: E. K. Krueger, pres. & gen. mgr.; J. C. Gadd, vice-pres.; D. G. Wells, secy. & treas.; E. D. Warde, sales mgr.; M. F. Reeves, supt. & plant mgr.; H. E. Cole, chief engr.; E. D. Carlson, dir. plastics research & chief chem.; A. C. Allen, adv. mgr. & dir. pub. rel.; G. L. Bereman Jr., pur. agent.
Presses: Compression, 16—10 to 200 ton.

KINGMAN, E. B. CO.
Division Ben Hur Products, Inc.
302 Fifth Avenue
New York, New York
Branch Office: Leominster, Mass.
Personnel: Thos. C. Howe, pres., gen. mgr. & pur. agent; S. F. Behr, vice-pres. & adv. mgr.; G. T. Creed, secy.; M. M. Hirtenstein, treas.; H. P. Wallach, sales mgr.; A. S. Schneider, chief engr.
Presses: Extrusion, 1—2½ in.; Injection, 2 to 8 oz.

KINGS SPECIALTY COMPANY
482 Baltic Street
Brooklyn, New York
Personnel: Jack Weisburst, owner; Forrest T. Weisburst, plant mgr.; Irving A. Weisburst, pur. agent.

KINGSBACHER-MURPHY CO.
683 Santa Fe Avenue
Los Angeles 21, California
Personnel: Alvin Kingsbacher & Walter G. Murphy, partners; Jack Rennick, sales mgr.; Mayers Co., adv. agent.

KINGSLEY STAMPING MACHINE COMPANY
1606 Cahuenga Blvd.
Hollywood 38, California
Personnel: Lewis A. Kingsley, pres.

KINKEAD INDUSTRIES, INC.
450 West Superior Street
Chicago 10, Illinois
Personnel: W. S. Kinkead, pres.; W. H. Wolf, treas.; R. G. Foote, pur. agent.

KINNEY MANUFACTURING CO.
3529-3541 Washington Street
Boston 30, Mass.
Branch Offices: Chicago; Los Angeles; N.Y.; Philadelphia; San Francisco.

KIPPY KIT COMPANY
Box 149
Circleville, Ohio
Personnel: L. E. Goeller, owner; E. S. Goeller, secy. & treas.; L. E. Goeller II, chief engr.

KIRBY COMPANY, The
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Cleveland 7, Ohio

KIRBY DIAL LIMITED
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Toronto 1, Ontario, Canada

KIRK, F. J. MOLDING CO.
Clinton, Massachusetts
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Presses: Injection, 2—4 oz., 3—8 oz.

KIRK & BLUM MFG. CO., THE
2838-52 Spring Grove Ave.
Cincinnati, Ohio
Branch Offices: Liberty Engr. Div., Indianapolis; Liberty Engr. & Mfg. Co., Louisville.

KIRK PLASTIC COMPANY
170 East Jefferson Boulevard
Los Angeles, California

KLINGBERG & HESTER
75 East Wacker Drive
Chicago 1, Illinois

KLISE MANUFACTURING CO.
50 Cottage Grove Street SW.
Grand Rapids 2, Michigan
Sales Offices: Amer. Furn. Mart Bldg., Chicago; Ted Burton, 10 Blenheim Rd., Columbus; 308 Security Bank Bldg., High Point, N.C.; 174 Sturgis St., Jamestown, N.Y.; 192 Lexington, New York.

KNAPP, JAMES H. CO.
4020 Loma Vista Avenue
Los Angeles 11, Calif.
Personnel: James H. Knapp, pres.; R. F. Cushman, vice-pres., treas. & gen. mgr.; H. H. Knapp, secy.; W. Snur, supt.; C. I. Gleason, chief engr.; C. Cosper, pur. agent.

KNIGHT, BURKE H.
50 East Forty-first Street
New York, New York

KNOEDLER, ALPHONSE & CO.
651 High Street
Lancaster, Pennsylvania
Personnel: Alphonse Knoedler, pres.; Karl Loos, vice-pres.; Francis Hoffman, secy. & treas.; John C. Lutz, gen. mgr.
Presses: Injection, 2—3 oz., 1—4 oz.

KNOEDLER CHEMICAL CO.
651 High Street
Lancaster, Pennsylvania
Personnel: Alphonse Knoedler, pres.; Karl Loos, vice-pres., chief engr. & chief chemist; F. S. Hoffman, secy., treas. & pur. agent.

KNU-VISE, INCORPORATED
2200 Eighth Street
Detroit 16, Michigan
Branch Office: 432B San Fernando Rd., Glendale, Calif.
Personnel: J. A. Herrington, pres. & treas.; Louis J. Portnoy, vice-pres. & secy.; Myron F. Barkus, gen. mgr. & plant mgr.; John F. Kowalik, sales & adv. mgr.; Fred W. Lampe, chief engr.; Fred C. Gumpper, pur. agent.

KOBLICK, FREDA
11 Columbus Avenue
New York, New York

KOCH, GEORGE SONS, INC.
2115 W. Ohio Sf.
Evansville 4, Indiana
Personnel: A. C. Koch, pres.; R. L. Koch, secy. & treas.; R. M. Koch, gen. mgr.; F. L. Elliott, chief engr.; E. E. Lyons, pur. agent.

KOGAN, BELLE
362 Fifth Avenue
New York 1, New York

KOLLER CRAFT PLASTIC PRODUCTS, INC.
Fenton, Missouri

KOPPERS COMPANY, INC.
Tar & Chemical Division
Pittsburgh 19, Penna.
Plant: Kobuta, Pa.
Personnel: J. N. Forker, vice-pres. & gen. mgr.; T. C. Keeling, sales mgr.; Ralph Winslow, adv. mgr.

KOPPLIN, KARL
7645 Florissant Road
St. Louis 21, Missouri
Branch Offices: Central Airport, Camden, N.J.; Hotel Sheldon, San Francisco.
Personnel: Karl Kopplin, pres.; A. H. Burris, vice-pres.; E. Taylor, secy. & treas.; K. E. Erickson, chief engr.; Wade Nash, chief chem.

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New York 21, New York

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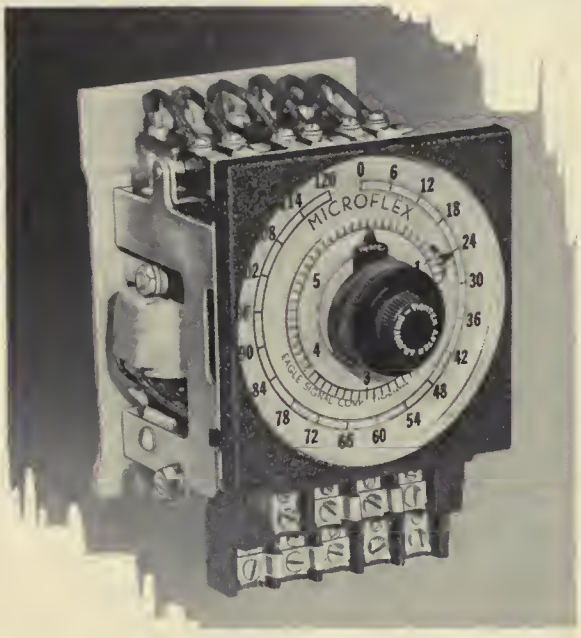

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Personnel: Edward Krasny & Arthur Rosen, partners.

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Chicago, Illinois

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Personnel: Michael Krieger, owner; S. Myles, secy.; B. Krieger, gen. mgr.

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New York 7, New York
Personnel: W. C. Grosskiaus, gen. mgr.

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Long Island City, New York

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Presses: Compression, 4—6 ton, 2—10 ton, 7—20 ton, 2—26 ton, 66—40 ton, 4—50 ton, 4—100 ton, 24—150 ton, 10—200 ton, 5—300 ton.

KUTCH, WALTER E. CO.
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Arlington, New Jersey

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LAFAYETTE TOOL & SUPPLY COMPANY
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New York, New York

LAKE ERIE ENGRG. CORP.
Buffalo, New York
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500 Rothbone Avenue
Aurora, Illinois
Personnel: Roy D. Raymond & Raymond Barnes, partners.
Presses: Injection, 3—8 oz., 1—12 oz.

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274 Madison Avenue
New York, New York

LAMI CAST PLASTICS
106 East Fourteenth Street
Konsas City, Missouri

LAMICOID FABRICATORS, INC.
3600 West Potomac Avenue
Chicago 51, Illinois
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LAMMERT AND MANN CO.
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Chicago 12, Ill.
Personnel: R. F. Lammert, pres. & treas.; Donald Badgley, vice-pres.; F. H. Byrne, secy.

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242 West 38th Street
New York, New York
Personnel: Henry Morgenstein, pres.; Albert Zuckerman, secy., treas., gen. & sales mgr. & pur. agent.

LAMOTEX CORP.
230 Fifth Avenue
New York 1, New York

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409 West Redwood Street
Baltimore, Maryland

LAMSON & SESSIONS CO., THE
1971 West 85th Street
Cleveland 2, Ohio
Personnel: Roy H. Smith, pres.; Geo. S. Case, ch. of bd.; J. F. Donahue, vice-pres. charge sales; H. H. Winterberg, secy.; Robert G. Patterson, asst. treas. & sales mgr.; T. R. Pleines, supt.; Harold J. McMahon, plant mgr.; C. L. Harvey, chief engr.; A. E. R. Peterka, adv. mgr.; George W. Hinds, pur. agent; W. G. Waltermire, sales & standards engr.

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Philadelphio 40, Pa.

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Chicago, Illinois

LANDERS, BERT A., INC.
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Los Angeles, California

LANDERS CORPORATION, THE
837 Buckingham Street
Toledo, Ohio
Personnel: R. G. Landers, pres. & gen. mgr.; F. W. Baker, vice-pres., supt. & plant mgr.; P. E. Roper, secy. & treas.; L. D. Stickney, vice-pres.; J. P. Howland, sales & adv. mgr.; Charles J. Chaban, dir. plastics research & chief chem.; Harry V. Coffy, dir. pub. rel.; J. C. Siegmann, pur. agent; Harold A. Lamlein, tech. controller.

LANDERS-SEGAL COLOR CO.
78 Delevan St.
Brooklyn 31, New York
Personnel: L. Landers & N. Segal, partners.

LANDIS MACHINE COMPANY
Church and Fifth Streets
Waynesboro, Pennsylvania

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New York 19, New York
Personnel: F. Huntington Babcock, pres.; Stuart H. Johnson, vice-pres.; W. E. Baxter, secy. & treas.; F. C. Denning, sales mgr. plastics div.

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Toledo, Ohio

LANSKY DIE CUTTING CO.
194 Greene Street
New York, New York
Personnel: Milton Lansky, owner; Samuel Galper, gen. mgr.; Martin Himmelstein, supt.

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164 Delancy Street
Newark, New Jersey

LA POINTE-PLASCOMOLD CORP.
Unionville, Connecticut
Personnel: Jerome E. Respess, pres.; Albert A. La Pointe, vice-pres.; Thomas C. Roberts, sales mgr.; Dr. R. F. Hoflin, dir. plastics research; J. J. Horan, pur. agent.

LA ROSE, W. T.
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Troy, New York

LARSON, A. P. COMPANY
29 Broadway
New York 6, New York

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Los Angeles, California

LATROBE ELECTRIC STEEL CO.
Latrobe, Pennsylvania

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Seattle, Washington

LAVORE, M. H.
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New York, New York
Personnel: M. H. Lavore & Sol Barry, partners.

LAW & CO.
Trust Building
Wilmington, North Corolino
Branches: Atlanta; Cordele, Ga.

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Philadelphia 3, Pennsylvania
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West Hollywood, California
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Personnel: Jodie H. Shows, owner, E. Goodyear, secy.; Leonard L. Lesiak, gen. mgr.; Jerre L. Podorson, sales mgr.; A. G. da Northall, chief engr.

LEA MFG. CO., THE
16 Cherry Avenue
Waterbury 86, Connecticut
Personnel: R. S. Leather, pres.; Charles W. Yerger, ch. of bd.; R. P. Crane, vice-pres. & sales mgr.; H. L. Kallner, secy.; E. W. Couch, treas. & gen. mgr.; Raymond Hughes, supt.; Henry L. Kellner, dir. plastics research; L. Verzier chief engr.; W. D. Starr, pur. agent.

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Personnel: Leonard Lederer, owner.

LEDOUX & CO.
155 Sixth Avenue
New York, New York

LEDIG, H. A.
7513 E. Tulpehocken St.
Philadelphio 38, Pennsylvania

LEE, OSCAR
226 South Wabash Avenue
Chicago, Illinois
Personnel: Oscar Lee & Marguerite K. Lee, partners; M. J. Coe, chief engr.

LEE PLASTICS
A & Lippincott Streets
Philadelphia 34, Pennsylvanio
Personnel: Louis Finkel, pres.; S. L. Luber, sales mgr.; J. Ray, plant mgr.; Urey Hocutt, chief engr.

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Los Angeles, California

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LEISTER-KAUFFMAN
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Factories: 1501 Webster St., Dayton; Leland Electric Can., Ltd., 50 Crimea St., Guelph, Ont., Can.

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LEPEL HIGH FREQUENCY LABORATORIES, INC.
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Los Angeles, California

LESCAZE, WM.
211 East 48th Street
New York 17, New York

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2711 Church Avenue
Cleveland, Ohio
Tool & Die Division: 1444 Hamilton Ave., Cleveland, Ohio.
Personnel: Nathan Lester, pres.; D. White, vice-pres.; Henry A. Rocker, secy.-treas.; William H. Schwartz, chief engr.

LESTER-PHOENIX, INC.
2711 Church Avenue
Cleveland 13, Ohio
Personnel: Nathan Lester, pres.; H. E. Bollinger, vice-pres.; David White, secy.; H. H. Jeck, treas.; Fred C. Ziesenheim; sales mgr.; W. H. Schwartz, chief engr.

LEVEY, HAROLD A. LABS.
8131 Oleander Street
New Orleans 18, Louisiana
Personnel: Harold A. Levey, owner; C. Dannenbaum, vice-pres.; Hal Levey, secy.; S. A. Levey, treas.; M. C. Kalter, chief engr.; G. D. Brown, chief chem.

LEVIEN, NED G., CO., INC.
40-17 22nd Street
Long Island 1, New York
Personnel: Ned G. Levien, pres., treas. & gen. mgr.; Edward Levien, secy.; Max Levien, supt.

LEVIN MFG. CO.
11-38 31st Avenue
Long Island City, New York

LEVIN, MONTE L.
2502 Clarendon Rd.
Brooklyn, New York

LEWIS, A. STEVEN
219 West Chicago Ave.
Chicago 10, Illinois
Personnel: A. Steven Lewis, owner; C. Garness, pur. agent.

LEWIS, J. D., INC.
Providence, Rhode Island

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40 Worth Street
New York, New York
Factory: Lewiston, Maine.
Personnel: A. A. Libbey, pres.; Wm. Deacon Jr., vice-pres. & gen. mgr.; W. Scott Libbey, treas.; Robert Morse, sales mgr.; A. F. Wheeler, chief engr.; Dorian Reed, dir. plastics research & chief chem.

LIBERTY MERCANTILE CO., INC.
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New York 1, New York
Personnel: A. Baum, pres.; Myron Blumner, secy., treas. & gen. mgr.; Alfred J. Baker, export mgr.

LIBERTY TOOL & MACHINE COMPANY
Irvington, New Jersey

LICHTEN, MAURICE A. CO.
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Orange, New Jersey
Personnel: Maurice A. Lichten, partner; Wm. E. Kennedy, treas.; Arthur S. Lichten, plant mgr. & pur. agent; Frank Koelsch, dir. plastics research; Arthur S. Lichten, plant mgr. & pur. agent.

LIEBES, DOROTHY W.
545 Sutter Street
San Francisco, California

LIETZKE DESIGNERS
627 West Market Street
Akron, Ohio

LIFETIME PLASTIC INC.
1744 Champa Street
Denver 2, Colorado
Branch Office: Oakland, Calif.
Personnel: J. A. Sundstrom, pres., treas. & gen. mgr.; R. E. Blank, vice-pres. & secy.; Lloyd M. Ingle, sales mgr. & pur. agent; A. L. Sundstrom, supt., plant mgr. & chief engr.; E. E. Tinker, dir. plastics research & chief chemist; W. M. Carroll, adv. mgr. & dir. pub. rel.
Presses: Compression, 1—500 ton; Laminating & Laboratory, 1.

LINCOLN ENGINEERING CO.
5701 Natural Bridge Avenue
St. Louis 20, Missouri

LINCOLN PRODUCTS CO.
P. O. Box 161
Fort Wayne, Indiana
Personnel: C M. Magers, owner; Wm. R. Byanski, gen. mgr.

LINCOLNSHIRE MFG. CO.
166 Essex
Boston, Massachusetts

LINDE AIR PRODUCTS CO.
Unit Union Carbide and Carbon
30 East 42nd Street
New York 17, New York

LINDENHURST MFG. CO., INC.
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Lindenhurst, N.Y.
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Presses: Compression, 35—150 ton; Injection, 1—4 oz.

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Pittsfield, Massachusetts

LINDY, M. L. CO.
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Irvington, N.J.

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518 Fifth Avenue
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Branch Office: 230 N. Michigan Ave., Chicago.
Personnel: J. Gordon Lippincott & Walter P. Margulies, partners; David Maxwell, dir. prod. development; J. Fairchild Fleming, dir. Chicago office.

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Los Angeles 22, Calif.
Branch Office: 1685 Kansas St., San Francisco.
Personnel: James Lithgow, owner; J. H. Mohr, vice-pres. San Francisco plant; M. P. Cedergren, secy. & treas.; Sellars Bush, sales mgr.; J. D. Lithgow Jr., supt.; Dr. D. A. Granicher, dir. plastics research.

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30 Memorial Drive
Cambridge 42, Mass.
Representative: 420 Lexington Ave., New York.
Personnel: Earl P. Stevenson, pres.; Thorne L. Wheeler, Roger C. Griffin & Raymond Stevens, vice-pres.; Frank N. Houghton, secy.; Henry G. Powning, treas.; Howard F. Hamacher, dir. pub. rel.; William Corey, pur. agent.

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Chicago 40, Ill.
Personnel: E. V. Sundt, pres.; T. M. Blake, exec. vice-pres.; B. M. Kollath, vice-pres.; C. H. Belford, office mgr.; R. G. Akin, sales dir.; F Barta, chief engr; Martin J. Pluth, adv. & sales promotion mgr.; G. F. Taft, pur. agent; D. G. Turmail, controller; A. H. Tracy, credit mgr.; J. D. Hughes, works mgr.; A. G. Schmitt, expeditor; Ben Jewell, chief inspector.

LIVINGSTON PLASTICS CORP.
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Logansport, Indiana

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Fort Worth, Texas
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Presses: Compression, 1—12 ton, 1—50 ton.

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Personnel: C. W. Hosteck, owner & pur. agent; S. A. Anthony Jr., sales & adv. mgr.; Frank Streichert, supt.

LOOMIS, EVARTS G., CO.
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Personnel: A. Prescott Loomis, pres.; R. Frank Atkinson, vice-pres.; Margaret L. Storie, asst. secy. & treas.; Fred S. Wemyss, sales mgr.; Orton Smalley, chief chem.; Nelson B. Winters, pur. agent.

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27 West 20th Street
New York 11, New York
Branch Office: Compo-Site Plastic Div., 85 Fifth Ave., Paterson, N.J.
Personnel: E. S. Lowe, pres.; S. C. Kirstel, gen. mgr.; George B. Stone, sales & adv. mgr.

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San Antonio 4, Texas

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1740 Military Road
Buffalo 5, New York

LUCIGEM PLASTIC CORP.
50-54 West 17th Street
New York 11, New York

LUFKIN RULE CO., THE
Saginaw, Michigan

LUMA ELECTRIC EQUIP. CO.
P.O. Box 132
Toledo 1, Ohio
Parsonnel: Robert L. Hinds, owner; A. L. Bolster, sales mgr.; P. H. Shire, plant mgr.

LUMIROL COMPANY, THE
153 East 26th Street
New York 10, New York

LUPOMATIC TUMBLING MACHINE COMPANY, INC.
4510 Bullard Avenue
New York 66, New York

LURITE CORP.
480 Washington Street
Newark 2, New Jersey

LUSTEROID CONTAINER CO.
10 Parker Avenue West
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Personnel: Richard H. Davis, pres. & treas.; Henry F. Colvin, vice-pres.; Roy F. Layton, secy.

LUSTRA-CITE INDUSTRIES
225 West 28th Street
New York 1, New York
Personnal: Milton M. Halpern, owner; sales mgr. & pur. agent; L. Lichter, secy.; Michael J. Harmon, gen. mgr.; Fred Schraeger, supt.

LYDON BROTHERS
229 Colden Street
Jersey City 4, N.J.
Personnel: Timothy Lydon, owner; P. J. Lydon, gen. mgr.

LYNN SIGN CO.
221-223 Endicott Street
Boston, Mass.
Parsonnel: Frank J. Sulesky, owner; Pauline C. Sulesky, secy.
Presses: Injection, 1—8 oz.

LYON METAL PRODUCTS, INC.
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Branch Offices: All principal cities.
Personnel: Frederick Z. Pearson, gen. mgr. plastics div.

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Greene, N.Y.
Representatives: All principal cities.
Parsonnel: George G. Raymond, pres.; Stanley R. Bryant, sales mgr.

M AND M WOOD WORKING COMPANY
Portland, Oregon

MacALLISTER, PAUL, INC.
26 East 55th Street
New York, New York
Personnel: Paul R. MacAlister, pres.

MacDONALD MFG. COMPANY
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Parsonnel: Stuart MacDonald, owner & pres.; Henry Michael, gen. mgr.; Walter Follbaum, supt.; Franklin Minion, chief engr.
Prasses: Injection, 1—2 oz., 1—4 oz., 5—8 oz., 1—9 oz., 1—16 oz.

McALEER MFG. CO.
4th & Water Streets
Rochester, Michigan
Personnel: Bradley Higbie, pres.; Carlton M. Higbie, ch. of bd.; F. A. Weihe Jr., Earl Lowe & Richard P. McMahon, vice-pres.; Duncan J. McNabb, vice-pres. & dir.; Vincent J. McAvoy, secy. & treas.; P. B. Palmar, sales mgr.; Robert E. Whalen, supt.; John J. Chechack, chief chem.; John K. Yount, dir. pub. rel.; T. E. Hogan, pur. agent.

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Norfolk, Virginia

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Chicago 54, Illinois

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Meadville, Pennsylvania

McDONALD MFG. CO.
544 East Thirty-first Street
Los Angeles 11, California
Personnel: J. D. McDonald, owner; T. B. Templin, sales mgr.; K. R. Mergen, supt.; Chas. Martins, chief engr.
Presses: Compression, 3—50 ton, 8—80 ton, 2—100 ton, 24 125 ton, 4—150 ton, 2—300 ton; Injection, 1—1½ oz., 1—8 oz.

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666 Lake Shore Drive
Chicago, Illinois

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Aurora, Illinois
Personnel: L. W. McDowell & W. J. Olinger, partners.

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Railroad Avenue and Mozart St.
East Rutherford, New Jersey

Mc GOUGH, R. A.
138 9th Street
Pittsburgh, Pa.

McINERNEY PLASTICS CO.
25 Commerce Avenue
Grand Rapids, Michigan

McKINNON IRON WORKS CO.
Ashtabula, Ohio

McNEIL MOLDING MACHINE CO., INC.
1352 N. Western Ave.
Chicago, Ill.
Personnel: Carl W. McNeil, pres.; Ray A. Franzen, vice-pres., secy. & treas.; W. Mink, gen. mgr.; Wm. Lannert, chief engr.

McQUAY AIRCRAFT CORP.
3301 East 22nd Street
Los Angeles 23, California

MAAS & WALDSTEIN CO.
438 Riverside Avenue
Newark, New Jersey

MACHINE TOOL DIVISION
Kalamazoo Tank & Silo Co.
508 Harrison Street
Kalamazoo 16, Michigan

MACK, JOHN & SON MOLDED PRODUCTS CO.
6227 North Broadway
Chicago 40, Illinois
Personnel: John Mack, Sr. & John L. Mack, Jr., partners.
Presses: Compression, 2—150 ton; Injection, 1—8 oz.

MACK MOLDING CO.
Wayne, New Jersey

MACK SALES COMPANY
1456 Jefferson Avenue
Buffalo 8, New York
Personnel: L. J. Mack, owner.

MAFFITT, HOWARD C.
522 Eleventh Street
Des Moines, Iowa

MAGIC NOVELTY CO.
132 West 21st Street
New York 11, New York
Personnel: Herman Neuberger, partner.

MAGNA MFG. CO., INC.
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New York 22, New York
Factory: Haskell, N.J.
Personnel: P. W. Phillips, pres. & treas.; C. N. Goodfellow, vice-pres.; E. Schmergel, secy.

MAGNAFLUX CORPORATION
5900 Northwest Highway
Chicago 31, Illinois
Branch Offices: Cleveland; Dallas; Datroit; Los Angeles; New York.

MAGNETIC PLASTICS CO.
1900 Euclid Avenue
Cleveland 15, Ohio
Personnel: W. H. Martin, owner.

MAGUN, HARRY L.
35 Fayette Street
New Haven, Connecticut

MAICO CO., INC., THE
21 North 3rd Street
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Parsonnel: L. A. Watson, pres.; W Patterson, vice-pres.; M. A. Mas secy.; Jim White, treas.; Tom G supt.; George Little, chief engr.; J. Miller, dir. plastics research; Freeman, adv. mgr.; Ken Hahn, p agent.
Presses: Compression, 1—35 ton, 4— ton, 1—80 ton, 3—150 ton; Inject 1—4 oz.

MAJESTIC MOLDED PRODUC
22-01 41st Avenue
Long Island, N.Y.
Personnal: C. W. Marsellus, pres. treas.; Henry Wish, vice-pres. & sec W. J. Ryshavy, supt.

MAJESTIC PLASTIC COMPAN
343 S.W. North River Drive
Miami, Florida
Branch Offices: Los Angeles; New Yo Wilmington, Del.
Personnel: Arthur H. Rubin, owner.
Presses: Compression, 6—up to 1 ton.

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7612 Southwest 13th Street
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Personnel: Arthur H. Rubin, pres. gen. mgr.; Martin S. Rubin, vice-pre David K. Rubin, secy. & treas.; Lou D. Lyon, sales mgr. Presses: Com pression, 1—5 ton, 1—10 ton, 1— ton, 2—50 ton.

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Parsonnel: A. W. Mall, pres. & ge mgr.; W. H. Sanders, secy. & treas. Carl Sigler, sales mgr.; Walter Selan der, supt.; M. Rehnquist, adv. mgr. John Innes, pur. agent.

MALLCO MFG. CO.
3 Great Jones Street
New York 12, New York
Personnel: Chas. Lapper, owner.

MALLINCKRODT CHEMICAL WORKS
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St. Louis 7, Missouri
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MANDERSCHEID COMPANY
810-812 W. Fulton Street
Chicago 7, Illinois
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Chicago 4, Illinois

MANNE-KNOWLTON INSULATION CO.
416 West 13th Street
New York 14, New York

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135 Leighton Avenue
Rochester 9, New York
Personnel: Daniel T. Manning, pres.; William T. Manning, vice-pres.

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Troy, New York

MANNING, MAXWELL & MOORE, INC.
Bridgeport, Connecticut
Branch Offices: Boston; New York; Tulsa.

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4601 Euclid
Cleveland 3, Ohio
Personnel: Don C. Green, owner.

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Los Angeles, California

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Branch Offices: Montreal; Vancouver; Winnipeg.
Personnel: F. E. Manton, supt.; C. Ross, plant mgr.; J. Bawtenheimer, pur. agent.

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(See Chemaco Corporation)

MANUFACTURER SCREW PRODUCTS
126-222 W. Hubbard Street
Chicago 10, Illinois

MANY, J. & CO.
153 Lafayette Street
New York 13, New York
Personnel: Julius Many, owner.

MAPLE LEAF PLASTICS LTD.
703 Bloor Street, West
Toronto 4, Ontario, Canada

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Chemical Division
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Branch Office: Menasha, Wis.
Personnel: D. C. Everest, pres. & gen. mgr.; Allen Abrams, vice-pres. & tech. dir.; John Stevens, vice-pres.; A. M. Van Douser, secy. & treas.; F. M. Truesdale, sales mgr. chem. div.; Grover Keeth, chief engr.; J. R. Salvesen, dir. plastics research; Dr. C. H. Harmon, chief chemist & mgr. chem. div.; R. Ganzer, dir. pub. rel.; W. M. Zahn, pur. agent.

MARBLETTE CORPORATION
37-21 30th Street
Long Island City, New York
Branch Offices: Chicago, Toronto; Sydney, Australia.
Personnel: Herbert C. Kranzer, pres. & treas.; Knud Andreasen, chief engr.; Samuel Glickstein, gen. & sales mgr.; Max Hilrich, chief chemist.

MARBON CORPORATION
1926 West 10th Avenue
Gary, Indiana
Personnel: G. P. F. Smith, pres.; Robert Shattuck, vice-pres. & plant mgr.; Matthew Keck, secy. & treas.; D. M. Pratt, sales mgr.; J. F. Showalter, supt.; A. J. Verplank, chief engr.; W. C. Calvert, dir. plastics research; A. G. Susie, chief chemist; Rhoda M. Stewart, pur. agent.

MARCO CHEMICALS, INC.
Sewaren, New Jersey
Personnel: I. E. Muskat, pres. & gen. mgr.; A. C. Buttfield, vice-pres.; M. Reynolds, secy., sales & adv. mgr.; R. E. Lee, treas.; J. N. Grove, pur. agent.

MARCRAFT PLASTICS
233 East Hennepin Ave.
Minneapolis 14, Minnesota
Personnel: Marshall Beaubaire, owner; George J. Mitchell, prod. mgr.

MARINE AIR RESEARCH
Essex, Connecticut

MARK NOVELTY CORP.
174 Broadway
Brooklyn 11, New York
Personnel: Fred Rolla, pres.; Louis Grossman, vice-pres. & gen. mgr.; Leonard M. Sternberg, secy. & treas.

MARKAL COMPANY
607 North Western Avenue
Chicago, Illinois
Personnel: L. Arononberg, owner, chief chem., & dir. plastics research; B. Lytton, gen. & adv. mgr.

MARKEM MACHINE COMPANY
Emerald Street
Keene, New Hampshire

MARKS CUSTOM PLASTIC CO.
1325 West Seventh Street
Los Angeles 14, California
Personnel: Leon Marks

MARKS PRODUCTS CO., INC.
84-90 North Ninth Street
Brooklyn 11, New York
Personnel: J. J. Grossman, pres.; J. J. Steinharter, gen. mgr.; Charles E. Carlson, adv. mgr.
Presses: Compression, 100 to 300 ton.

MARSH WALL PRODUCTS, INC.
Dover, Ohio
Personnel: A. C. Marsh, pres.; V. R. Marsh, vice-pres. & gen. mgr.; John J. Marsh, secy. & sales mgr.; J. H. Marsh, treas.; S. A. Kinsey, supt. & plant mgr.; J. J. Robinson, chief engr.; M. R. Weber, adv. mgr.; Hugh Niuman, chief chemist; C. F. Fernsell, pur. agent.
Presses: Extrusion. 1—2½ in.

MARSHALL, WILLIAM L. LTD.
427 East 10th Street
New York 9, New York
Personnel: George T. Kinley, pres.; E. Roy Moffat, gen. mgr.; John Henry Smith, sales mgr.

MARTIAL & SCULL
1 East 53rd Street
New York 22, New York
Personnel: Jacques Martial, partner; Robert C. Scull, partner & dir. plastics research; Claude Bars, office mgr.; N. Zimmerman, chief engr.; E. A. Kuivinen, dir. pub. rel.

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600 Alden Street
Springfield 9, Massachusetts

MARTIN, RAY C.
560 Main St.
Sayreville, New Jersey

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MARX, ERICH
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Los Angeles 5, California

MARYLAND PLASTICS, INC.
251-257 East Central Avenue
Federalsburg, Maryland

MASKITE ADHESIVE COMPANY
6005 South Gramercy Place
Los Angeles 44, Calif.
Personnel: H. E. Bash & W. E. Alexander, partners.

MASONITE CORP., THE
111 West Washington Street
Chicago 2, Illinois

MAST DEVELOPMENT CO., INC.
2110 E. 11th Street
Davenport, Iowa
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2415 Prairie Avenue
Chicago 16, Illinois
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MASTER METALCOATERS
2415 South Prairie Avenue
Chicago, Illinois

MASTER PLASTIC MOLDING CORPORATION
1609 North Broadway
St. Louis 6, Missouri
Personnel: D. B. Blossom, pres.; L. R. Klingler, vice-pres. & gen. mgr.; R. H. Charles, secy; Robert A. Lloyd, vice-pres. & sales mgr.

MASTERCRAFT PLASTICS CO.,
95-01 150th Street
Jamaica, Long Island, New York
Personnel: Foster Monaco, pres. & plant mgr.; Roe Monaco, vice-pres. & supt.; I .H. Weiss, secy.; E. Gilbert, treas. & sales mgr.

MATHIESON ALKALI WORKS
60 East 42nd Street
New York, New York

MATTEL CREATIONS
6058 S. Western Avenue
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Personnel: Harold Matson & Elliot Handler, partners.

MATTHEWS, JAS. S.H. & CO.
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Pittsburgh 13, Penna.

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New York, New York

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New York 16, New York
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Chicago 7, Illinois
Personnel: B. Maxant, pres.; R. E. Maxant, vice-pres.; Wm. H. Maxant, secy.; Edw. A. Maxant, treas.; J. D. Recht, sales mgr.; W. R. Brunken, supt.; R. J. Rieck, plant mgr.

MAXIM CHEMICAL CO., INC.
44 Cliff Street
New York, New York

MAXWELL, CURTIS F.
504 Sterling Building
Houston 2, Texas

MAYFAIR MOLDED PRODUCTS CORPORATION
4440 N. Elston Avenue
Chicago, Illinois
Personnel: Luther J. Evans, pres. & sales mgr.; Glenn Adams, vice-pres.; Robert Urban, secy. & chief engr.; David K. Evans, treas. & pur. agent.
Presses: Compression, 14—up to 60 tons.

MAYFAIR PLASTICS DIV.
Ulanet, Geo. Co.
Newark 5, N.J.
Personnel: H. Ulanet, owner.

MAYWALD, ELMER C.
11 South La Salle Street
Chicago 3, Illinois
Branch Office: Fort Wayne, Ind.

MAYWALD, FREDERICK J.
301 Hoboken Road
Carlstadt, New Jersey

MEAD & COMPANY
P. O. Box 3348
Jefferson Station 14
Detroit, Michigan
Plant: 9011 Central Avenue, Detroit.
Personnel: John Mead Jr., owner; Irma Mead, secy.; Fred Nagel, gen. mgr.; W. C. Young, chief engr.

MEAD SPECIALTIES CO.
4114 North Knox Avenue
Chicago 41, Ill.
Personnel: T. E. Mead, partner; E. G. Case, sales mgr.; M. J. Lieser, plant mgr.; C. L. Lindstedt, chief engr.; J. E. Mead, adv. mgr.; S. F. Stryker, pur. agent.

MEARL CORP.
153 Waverly Place
New York 14, New York
Personnel: Francis Earle, pres.; Burton G. Turner, vice-pres. & plant mgr.; H. Mattin, treas. & chief chem.

MEARS-KANE-OFELDT, INC.
1903-1915 East Hagert Street
Philadelphia 25, Penna.
Personnel: Edward W. Mears, pres.; Frederick K. Mears Jr., secy.

MECHANICAL MOLD & MACHINE CO., THE
962 South High Street
Akron 11, Ohio

MECHANICAL MOLD CO.
Akron, Ohio

MECHANICS ENGINEERING
Box 243
Jackson, Michigan
Personnel: Thomas Harry Jr. & Clifford D. Burbank, partners.

MECHANICAL INSTITUTE
115 Cedar St.
Boonton, N.J.
Personnel: Fred K. Weiss Sr., pres.; Fred K. Weiss Jr., vice-pres.
Presses: Compression, 1—15 ton; Injection, 1—8 oz.

MECOBOARD, INC.
1608 Conway Building
Chicago, Illinois
Personnel: Thomas H. Riley, exec. vice-pres.

MECUM, CLARKE W.
2876 Middletown Road
Bronx 61, New York
Personnel: Clarke W. Mecum, owner.

MEHRER, TED
101 Park Avenue
New York 17, New York

MEISSNER MFG. CO.
628 Bellmont Street
Mt. Carmel, Illinois

MELIND, LOUIS CO.
362 West Chicago Avenue
Chicago 10, Ill.
Branch Offices: Detroit; Los Angeles; New York; San Francisco.
Personnel: Louis Melind, pres.; Joel Yager, vice-pres.; Roy L. Melind, secy.; Luella Mann, treas.; David B. Sterrett, gen. mgr.; W. B. Stewart, dir. pub. rel., sales & adv. mgr.; Don Cobb, plant mgr.; J. R. Umbach, dir. plastics research & chief chem.; Paul Bulck, pur. agent.

MENARD, OMER A.
301 East 53rd Street
New York 22, New York

MENGEL COMPANY
Louisville, Kentucky

MEREDITH, SIMMONS & CO., LIMITED
363-379 Wallace Avenue
Toronto, Ontario, Canada

MERIT PRODUCTS INC.
4373 Melrose Avenue
Los Angeles, Calif.
Personnel: T. F. Bonkowski, pres.; Arnold Kunody, vice-pres.; Harry Pokras, secy. & treas.

MERIX ANTI-FOG
Division Merix Photo Co.
Wrigley Building, Chicago 11, Ill.
Personnel: Eric O. Sonneman, owner & gen. mgr.; E. Arshack, secy.; K. Sonnemann, treas.; Max Sonneman, sales mgr.

MERKERT AND SONS
70 Fulton Street
New York 7, New York
Personnel: Charles J. Merkert & Charles J. Merkert, Jr., partners.

MERRI-PLASTIC CO.
419 South Western
Los Angeles 5, California

MERRITT ENGINEERING AND SALES CO., INC.
120 South Niagara Street
Lockport, New York

METALLIC PLASTICS CO., INC.
20 Broome Street
Newark, New Jersey
Personnel: Jules Tepper, pres.; Irving J. Walker, vice-pres. & dir. plastics research; Harry Tepper, secy. & gen. mgr.; Victor E. Graham, treas.

METALLOPLAST MFG. CO.
88 Coit Street
Irvington, N.J.
Personnel: Ernest Mueller, owner.

METALTEX, INC.
100 Nassau Street
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South Ozone Park, Long Island, New York
Personnel: Charles Fischett, owner; Vincent Fischett, gen. mgr.
Presses: Injection, 1—2 oz.

NATIONAL FIBRE CO.
Toronto, Ontario, Canada

NATIONAL LOCK COMPANY
1902 Seventh Street
Rockford, Illinois
Personnel: A. J. Strandquist, pres.; M. A. Sommer, vice-pres. & treas.; A. H. Charles, vice-pres. & gen. mgr.; W. A. Weymouth, vice-pres. in chg. plastics div.; John Kraman, supt.; R. E. Larson, chief engr.; Carl Stokstad, pur. agent.

NATIONAL OIL PRODUCTS CO.
Harrison, New Jersey
Subsidiary: Metasap Chemical Company, Inc.

NATIONAL PAINT PRODUCTS
500-R Chancellor Avenue
Irvington 11, N.J.
Personnel: B. Frank Helwig, pres.; E. P. Miller, vice-pres., secy. & treas.; B. Miller, plant mgr.; R. J. Williams, pur. agent.

NATIONAL PLASTIC COMPANY
6819 Avalon Boulevard
Los Angeles 3, California
Branch Offices: 30 E. Adams St., Chicago; 55 W. 42nd St., New York.
Personnel: M. E. Rothschild & M. Sagar, partners.

NATIONAL PLASTIC PRODUCTS
7478 Woodrow Wilson
Detroit 6, Michigan
Personnel: Albert Chicorel & Max Chicorel, partners; Harvey Sibrack, treas.; William Cooper, sales mgr.

NATIONAL PLASTIC PRODUCTS COMPANY
Odenton, Maryland

NATIONAL PLASTICS, INC.
2330 McCalla Avenue
Knoxville 2, Tennessee
Personnel: C. Van Deventer III, pras.; M. Copeland, secy.-treas.; R. R. Spencer, sales mgr.
Presses: Compression, 2—200 ton, 4—300 ton, 1—150 ton; Hobbing, 1—600 ton; Injection, 1—1¼ oz.

NATIONAL RESEARCH & MFG. COMPANY
541 Second Avenue
San Diego, California
Presses: Hydraulic, 1—600 tons, 1—10 tons.

NATIONAL RUBBER MACHINERY COMPANY
917 Sweizer Ave.
Akron, Ohio
Branch Offices: Columbiana, O.; Clifton, N.J.

NATIONAL SCREW & MANUFACTURING COMPANY, THE
2440 East Seventy-fifth Street
Cleveland 4, Ohio
Branch Offices: New York, Detroit, Chicago, Cincinnati.

NATIONAL SCULPTURE SERVICES
304 West 42nd Street
New York 18, New York
Personnel: Alax J. Ettl, tach. dir.; M. J. Liaderman, adv. mgr.

NATIONAL TESTING LABS.
135 University Avenue
Rochester, New York

NATIONAL TOOL & MFG. CO.
100-124 North 12th Street
Kenilworth, New Jersey

NATIONAL TRANSPARENT MFG. CO.
28 West 25th Street
New York 10, New York
Personnel: Felix Rodd, ownar.

NATIONAL TRANSPARENT PLASTICS CO.
Indian Orchard
Springfield, Massachusetts
Branch Office: 350 Fifth Ava., Naw York.
Personnel: Arnold Aronson & Russell Chapin, partners.

NATIONAL VARNISHED PRODUCTS CORPORATION, THE
211 Randolph Avenue
Woodbridge, New Jersey
Personnel: Frederick M. Damitz, pres.; Viktor Bator, secy.; Paul H. Kempner, treas.; Stephen Sichermann, sales mgr.; Leo J. Stage, chief chemist; Laonard Schork, plant mgr.
Presses: Extrusion, 2—2½ in.

NATIONAL VULCANIZED FIBRE COMPANY
Maryland Avenue & Beech Street
Wilmington 99, Delaware
Branch Offices: 15 E. Saratoga St., Baltimore; 19 Daerfield St., Boston; 2808 W. Lake St., Chicago; 626 Broadway, Cincinnati; 1404 E. 9th St., Cleveland; Cooper Bldg., Denver; Kales Bldg., Detroit; Woodside Bldg., Greenvilla, S.C.; 2325 E. 8th St., Los Angeles; 739 N. Broadway, Milwaukee; 153 Court St., New Haven; 30 Church St., New York; Girard Trust Bldg., Philadelphia; Oliver Bldg., Pittsburgh; Powers Bldg., Rochester; 4903 Delmar Blvd., St. Louis; 273 Seventh St., San Francisco; 1927 First Ave. S., Seattle; National Fibre Co. of Canada Ltd. at 1411 Crescent St., Montreal and 107 Atlantic Ave., Toronto.
Personnel: J. W. Marshall, pres.; J. K. Johnston, vice-pres.; F. I. Crow, secy.; T. C. Taylor, treas.; H. C. Hackett, sales & adv. mgr.; E. C. Graasser, supt.; F. A. Cobb, chief engr.; G. H. Mains, dir. plastics resaarch; F. L. Stiegler, chief chemist; W. E. Friday, dir. pub. rel.; J. P. Eckles, pur. agent.

NAUGATUCK CHEMICAL DIV.
United States Rubber Co.
1230 Avenue of the Americas
New York, New York
Personnel: John P. Coe, vice-pres. & gen. mgr.; H. I. Baadle, sales mgr. plastics-chemicals; M. G. Shepard, plant mgr.

NAYLOR & NAYLOR
Toronto, Ontario, Canada

NEAL & BRINKER CO.
17 Murray Street
New York 7, New York

NEO A CORPORATION
6 East 53rd Street
New York, New York
Branch Office: New Hamburg, New York.
Personnel: Norman E. Olin, pres., chief chemist & dir. publ. rel.; C. Olin secy., treas., & pur. agant.

NEO DESIGNS CO.
6 East 53rd Street
New York, New York
Branch Office: New Hamburg, N.Y.
Personnel: Norman E. Olin, pras.; J. Olin, vice-pras.; C. Olin, secy. & treas.

NEO PLASTICS PRODUCTS CO.
55 West 42nd Street
New York 18, N.Y.
Plant: Havarstraw, N.Y.
Personnel: Gragory N. Soussloff, partner; Dimitri G. Soussloff, tachnical d
Presses: Injection, 3—12 oz.; Compression, 150 ton.

NETTLETON, W. O. & ASSOC.
54 Water Street
Guilford, Connecticut

NEVILLE COMPANY, THE
Neville Island
Pittsburgh 25, Pennsylvania
Personnel: W. S. Gardiner, exac. vice-pres.; E. Hodge, Jr., pras.; John C. Bane, Jr., sacy.; D. W. Kelso, traas. Lee V. Daular, sales & adv. mgr.; L. M. Gaigar, chiaf chamist & dir. plastics rasearch; H. J. Shaarar, supt.; H. N. Dauler, chairman of board.

NEWARK DIE COMPANY, THE
Newark, New Jersey

NEW ADVANCE MACHINERY COMPANY, THE
208 East Central Avenue
Van Wert, Ohio
Personnel: F. W. Fraylick, pres., gen. mgr. & pur. agent; R. L. Heath, vice-pres. & plant mgr.; H. E. Blank, treas.

NEW ENGLAND BOX CO.
173 Main Street
Greenfield, Massachusetts
Branch Offices: 100 East 42nd Street New York; Rochester, N.Y.; Chelsea Mass.; Springfield, Mass.
Personnel: L. F. Dickinson, pres. Nathan Tufts, vica-pres., gen. mgr. & sales mgr.; I. F. Atwood, vica-pres. in chg. of sales; Wm. Scott Keith, secy. W. E. Dickinson, treas.

NEWELL, J. O., INDUSTRIES
43 Boulton Avenue
Toronto, Canada

NEW ENGLAND NOVELTY CO.
98 Adams Street
Leominster, Massachusetts

NEW ENGLAND SCREW CO.
Emerald Street
Keene, New Hampshire
Personnel: Grant J. Holt, pras. & traas. Grant B. Holt, vice-pres., sacy., & sales mgr.; Lloyd Hawitt, pur. agent Frank Jucius, supt.; Jack Gandy, chief angr.; adv. agcy. Callaway Assoc Boston.

NEW-FIELD MACHINED PARTS COMPANY
7160 Melrose Avenue
Los Angeles 46, California
Branch Offices: Sales dept., 549 West Randolph Street, Chicago 6, Illinois Export division, 80 Broad Street, New York, N.Y.
Personnel: Harry Canfield & Strohm Newell, partners; Charles J. Shaw sales mgr.

NEW HERMES ENGRAVERS
821 Broadway
New York 3, New York
Personnel: Norbart Schimmel, owner.

NEW JERSEY ZINC SALES CO.
160 Front Street
New York 7, New York
Branch Offices: 221 North LaSalle Street, Chicago 1; 137 Kneeland Street, Boston 11; 93B Guardian Building, Cleveland 14; 1105 Merchants Exchange Building, San Francisco 4.

NEW METHOD STEEL STAMPS
147 Jos. Campau Street
Detroit 7, Michigan
Branch Offices: All principal cities.
Personnel: A. O. Lundell, pres.; R. Lagerfeldt, sales mgr.; C. O. Malmstrom, plant mgr.

NEW ONYX PLASTIC AND NOVELTY COMPANY
510 Broadway
Brooklyn, New York
Personnel: L. Stieglitz, pres.; A. Marino, vice-pres.; A. Martin, secy.; F. DeNicola, treas.

NEW PLASTIC CORPORATION
1017 North Sycamore Avenue
Hollywood 38, California

NEWPORT, HERBERT J. JR.
210 Darby Road
Llanerch, Pennsylvania
Personnel: J. Herbert Newport, Jr., owner & gen. mgr.; S. V. Gilbert, sales mgr., plant mgr. & pur. agent; Albert Schopfer, supt.

NEWPORT INDUSTRIES, INC.
230 Park Avenue
New York, New York

NEW YORK AIR BRAKE CO.
Hydraulic Div.
420 Lexington Avenue
New York 17, New York
Factories: Watertown, N.Y.
Branch Office: 122 So. Michigan Ave., Chicago.

NEW YORK PRODUCE EXCHANGE
2 Broadway
New York, New York

NEW YORK QUININE & CHEM. WORKS, INC., THE
119-117 North 11th Street
Brooklyn, New York

NEW YORK TESTING LABS.
80 Washington St.
New York, New York

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U. S. Vanadium Corp. (Union Carbide & Carbon Corp.)
925 Niagara Bldg.
Niagara Falls, N.Y.
Branch Offices: Sales Office, 910 Niagara Bldg., Niagara Falls; 30 East 42nd St., N.Y. City.
Personnel: J. W. McLaughlin, vice-pres. & gen. mgr.; C. J. Herrly, sales mgr.; J. Galaba, adv. mgr.; F. J. McMahon, pur. agent; A. M. Matheson, chief chemist.

NIAGARA ALKALI COMPANY
60 East 42nd Street
New York, New York

NIAGARA INSUL BAKE SPECIALTY COMPANY
383 Delaware Avenue
Albany 1, New York

NIAGARA MACHINE & TOOL WORKS
637-697 Northland Ave.
Buffalo 11, New York

NICE, PAUL S.
1112 Seventeenth Street
Denver, Colorado

NICHOLL HARD CHROME SERVICE
1350 Grinnell
Detroit 13, Michigan
Personnel: V. J. Nicholl & J. A. Nicholl, partners; S. R. Nicholl, gen. mgr.; E. A. White, sales mgr.

NICHOLS PLASTIC & ENGINEERING CO.
1744 West 59th Place
Los Angeles, California
Personnel: W. O. Nichols, owner, gen. mgr. & chief engr.; Wm. T. Miles, sales & adv. mgr., & pur. agent; Willard Crofut, plant mgr. & supt.; Alfred Eastwood, dir. publ. rel.
Presses: Compression, 4—60 ton, 3—200 ton, 1—400 ton; Transfer, 2—175 ton; Injection, 1—8 oz.

NICHOLS PRODUCTS CO.
325 West Main Street
Moorestown, New Jersey

NICHOLSON FILE CO.
44 Acorn Street
Providence 1, Rhode Island
Personnel: Paul C. Nicholson, pres. & gen. mgr.; Augustus E. Saunders, vice-pres. & secy.; S. Foster Hunt, vice-pres.; R. Lindley Murray, treas.; Harry L. Whitney, dir. of sales; George R. Ashbey, adv. mgr.; William H. Hunt, pur. agent; John E. Wiggins, supt.

NICHOLSON, W. H. & CO.
12 Oregon Street
Wilkes-Barre, Pennsylvania
Personnel: S. T. Nicholson, pres.; H. S. Nicholson, vice-pres. & gen. mgr.; R. S. Nicholson, secy.; W. R. Nicholson, treas.; H. L. Johnson, chief engr.; H. S. Nicholson Jr., pur. agent.

NICLAUS, WILLIAM L.
148 Grove Street
East Paterson, New Jersey

NIXON NITRATION WORKS
Nixon, New Jersey
Personnel: Charles Schuster, pres. & gen. mgr.; Stanhope W. Nixon, ch. of board; M. W. Peters, vice-pres., sales & adv. mgr.; Morris Breitkopf, secy.; O. S. Blaine, treas.; Robert Linzer, dir. plastics research; H. A. Hendrickson, pur. agent.

NOBLE & WESTBROOK MANUFACTURING COMPANY, THE
Westbrook St.
East Hartford 8, Conn.
Personnel: G. Edgar Westbrook, pres.; Wm. C. Westbrook, vice-pres. & gen. mgr.; Howard B. Noble, vice-pres.; Richard H. Gunther, sales mgr.; George A. Phillips, supt.

NONPAREIL MFG. CO.
37 West 28th Street
New York 1, New York
Personnel: Isaac & Nissim Dishy, partners.

NOOTER, JOHN, BOILER WORKS
1401 S. Second St.
St. Louis 4, Missouri
Personnel: Harry Nooter, pres.; Elmer J. Nooter, vice-pres. & sales mgr.; Robt. J. Ryan, vice-pres. & gen. mgr.; S. C. Tracy, secy. & treas.; Walter B. Meyer, adv. mgr. & dir. publ. rel.; Herbert Lurtz, pur. agent; H. A. Frith, plant mgr. & supt.; J. Harvey Yeager, chief engr.

NORCO PLASTICS CO.
3204 W. Vliet St.
Milwaukee 8, Wisconsin
Personnel: E. D. Taylor, pres.; Irven A. Pollak, vice-pres.; Ernest P. Mallon, vice-pres. & chief engr.; T. E. Higgins, secy., treas., & gen. mgr.
Presses: Compression, 1—250 ton, 1—75 ton.

NORFOLK TESTING LABS.
288 Bank Street
Norfolk, Virginia

NORTH AMERICAN ELECTRIC LAMP COMPANY
1014 Tyler St.
St. Louis 6, Missouri
Personnel: Charles M. Rice, pres.; Ella O. Cohn & D. R. Cohen, vice-pres.; Louis Lander, secy., treas., gen & sales mgr.; H. N. Adelstein, pur. agent.

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100 East 42nd Street
New York 17, New York
Factories: Dobbs Ferry, N.Y., Mt. Vernon, N.Y.; Lewiston, Me.
Personnel: P. F. S. Otten, pres.; H. F. van Walsem & O. M. E. Loupart, exec. vice-pres.; N. Ammeral & E. Hijmans,

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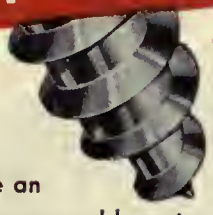

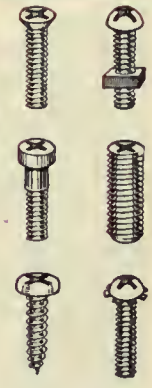

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NORTHEASTERN MOLDING CO.
Division New Haven Screw Machine Products Co.
15 Whiting St.
New Haven, Conn.

Personnel: Marshall R. Howard, gen. mgr.

Presses: Compression, 10—25 ton, 16—75 ton, 2—300 ton; Injection, 1—2 oz.

NORTHEASTERN PLASTICS
588 Commonwealth Avenue
Boston 15, Massachusetts

Personnel: Adolph Ullman, pres.; M. V. Lynch, treas.; Harry O. Sandberg, gen. & sales mgr.; Arthur Cornez, supt. & plant mgr.

Presses: Injection, 2—4 oz., 2—8 oz.

NORTHERN INDUSTRIAL CHEMICAL CO.
7-11 Elkins Street
South Boston 27, Massachusetts

Branch Offices: Cleveland; New York.

Personnel: G. Victor Sammet, pres.; Joseph C. Fuller, vice-pres. & secy.; Hans H. Wanders, vice-pres. & dir. plastics research; B. E. Schlesinger, treas.; F. Reed Estabrook Jr., sales mgr.; T. H. McNicholas, plant mgr.; George V. Sammet Jr., pur. agent; James Stewart, chief engr.

NORTHWEST PLASTICS, INC.
2233 University Avenue
St. Paul, Minnesota

Branch Office: 612 N. Michigan Ave., Chicago.

Personnel: C. C. Dailey, Jr., pres. & gen. mgr.; Wm. H. Mahle, vice-pres., sales mgr., chief eng. & chief chemist; E. G. Henderson, secy. & adv. mgr.; T. C. Macoubrey, treas.; Elliot Magraw, pur. agent.

Presses: Compression, 3—200 ton, 1—150 ton, 10—100 ton; Injection, 2—8 oz.

NORTHWEST SYNDICATE, INC.
711 St. Helens Avenue
Tacoma 1, Washington

Plant: 1321 A St., Tacoma, Wash.; sales representatives in principal cities.

Personnel: George F. Russell, pres.; Julius W. Mann, vice-pres.; H. J. Field, secy.; James E. Macpherson, treas.; Harvey G. Wheeler, supt.

NORTHWEST TESTING LABS.
Second Avenue and James Street
Seattle, Washington

NORTHWESTERN PLASTICS CO.
231 W. Superior St.
Chicago 10, Ill.

Personnel: John B. Daly, owner; W. T. Roose, supt. & chief engr.; John Kirby, plant mgr.

Presses: Compression, 4—35 to 100 ton, 1—175 ton, 1—350 ton, 2—450 ton.

NORTON, ARTHUR J.
2919 First Ave. South
Seattle 4, Wash.

Personnel: Arthur J. Norton, owner; D. M. Norton, treas.; G. O. Orth Jr., gen. mgr.

NORTON COMPANY
1 New Bond Street
Worcester 6, Massachusetts

Branch Offices: Chicago; Cleveland; Denver; Detroit; Hartford; Los Angeles; New York; Philadelphia; Pittsburgh; Hamilton, Ont.

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Personnel: George N. Jeppson, pres.; Ralph M. Johnson, vice-pres. & gen. sales mgr. abrasive div.; Frank W. Smith, vice-pres. & gen. mgr., mach. div.; A. B. Holmstrom, vice-pres. & gen. mgr. abrasive div.; W. T. Montague, vice-pres. & dir. publ. rel.; Clifford S. Anderson, secy.; Milton P. Higgins, treas.; C. L. Shaw, adv. mgr.; Paul Fielden, dir. of pur.; Milton Beecher, dir. of research; Clarence Daniels, plant mgr.; S. S. Kistler, dir. plastics research.

NORTON LABORATORIES, INC.
520 Mill Street
Lockport, New York

Branch Offices: 9 S. Clinton St., Chicago; 347 Fifth Ave., New York.

Personnel: J. B. Neal, pres. & gen. mgr.; M. L. Seekins, vice-pres. & plant mgr.; L. C. Laubacker, secy.; W. H. Hoenig, treas. & pur. agent; H. G. Valentine, vice-pres. & sales mgr.; W. J. Leyden, supt.; J. W. Stecke & A. T. Bryant, engr.; J. A. Peck, chief chemist; J. B. Shanley, dir. publ. rel.

NOSCO PLASTICS
Div. National Organ Supply Co.
17th & Cascade Streets
Erie, Pennsylvania

Personnel: Harry H. Kugel, pres. & gen. mgr.; Reuben G. Kugel, secy., treas., & pur. agent; Stanley E. Fuller, dir. publ. rel. & personnel; R. J. Winterger, sales mgr.; C. W. Kufner, supt.; Harold S. Cloyd, chief engr.; Bruno C. Roehrl, chief chemist.

Presses: Injection, 5—4 oz., 1—6 oz., 8—8 oz.

NOVELART MFG. CO.
799 Towne Ave.
Los Angeles 21, California

Personnel: Louis Weisman, gen. mgr.

NOVEL-CRAFT MFG. CO.
58 East 11th Street
New York 3, New York

NU-DELL MFG. CO.
2250 North Pulaski Road
Chicago 39, Illinois

Branch Office: 200 5th Ave., New York.

Personnel: A. A. Nudell & I. J. Nudelman, partners; M. R. Sangerman, partner, gen. & sales mgr.; J. B. Mosak, chief engr. & dir. plastics research; L. Lewis, plant mgr. & pur. agent.

Presses: Injection, 5—4 oz., 3—8 oz. 1—22 oz.

NU-ENGINEERING COMPANY
1515 Bonner Ave.
Ferndale 20, Michigan

Branch Office: Newark Plastic Engineering Company, 130 E. Locust St. Newark, O.

Personnel: J. Neuman, partner; A. Mellier, vice-pres. & gen. mgr.; F. B. Goulait, secy. & treas.; M. W. Burkhaplant mgr.

NU-LITE PLASTICS
374 Bloomfield Avenue
Verona, New Jersey

Personnel: W. J. Matt, Jr., owner.

NUSSBAUM, F. J. & CO.
473 Hudson Avenue
Brooklyn, New York

Personnel: Frank J. Nussbaum & Juliane Nussbaum, partners.

NUTMEG CHROME CORP.
79 Chapel Street
Hartford 3, Connecticut

Personnel: Arthur W. Logozzo, pres. Arthur Fontane, secy. & treas.

NUTONE INC.
931 East 31st Street
Los Angeles, California

NUTTING, H. C. CO.
4120 Davis Lane
Cincinnati, Ohio

Branch: Miami.

NU-WORLD PRODUCTS CO.
303 Third St.
Huntington Beach, California

Personnel: Gordon F. Samuel, pres. gen. mgr.; Arthur Linkletter & Lo deFalco, vice-pres.; R. R. Winger, secy & treas.; William Vroom, sales mgr Norman Tolle, adv. mgr. & dir. pub rel.; Cecil Weaver, supt. & plant mgr. C. K. Castaing, dir. plastics research Raymond Winger, chief engr.

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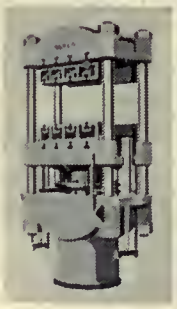

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rsonnel: J. A. Carter, asst. to pres.

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w York 17, New York
rsonnel: Gordon Obrig, pres.

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East 51st Street
w York 22, New York
nch Offices: 2087 Aylmer St., Montal; 461 10th Ave., New York.
rsonnel: Theo. E. Obrig, pres.; Philip Salvatori, vice-pres.; Americo Ori-, tech. dir.; Mae A. Wagner, dir. blic relations.

CONNELL, D. C.
0 Grand Concourse
w York 51, New York
rsonnel: D. C. O'Connell, owner.

DEL TOOL & DIE CO.
20 Grinnell Avenue
troit, Michigan
rsonnel: A. Olson & F. Wiswedel, rtners.

HIO ADVERTISING DISPLAY COMPANY
16-1220 Jackson Street
ncinnati 10, Ohio

HIO-APEX, INC.
tro, West Virginia
rsonnel: Andrew A. Payne, pres.; rnard H. Jacobson, gen. mgr.; Evan rris, supt.; A. H. Adler, chief engr.; as. O. Locke, chief chemist; N. S. unt, adv. mgr.; Clayton W. Scully, r. agent.

HIO CRANKSHAFT CO., THE
00 Harvard Avenue
eveland 1, Ohio

HIO PLASTIC COMPANY, THE
azeysburg, Ohio
nch Office: Barr Bldg., Washington, C.
rsonnel: George N. Edwards, pres. & n. mgr.; William Willcox, vice-pres.; V. Willcox, secy.; C. P. Willcox, as.; H. Charles Simons, mgr. indus- al sales; Edward A. Kanavel, supt. plant mgr.; H. Charles Simons, chief gr.; Calvin A. Downey, pur. agent.
sses: Injection, 3—1½ oz., 2—8 oz.

HIO TRAVELING BAG MFG. CO., THE
2 Prospect Avenue, S.E.
eveland, Ohio
rsonnel: H. Schechtman, gen. mgr.

ILGEAR COMPANY, THE
01-1417 West Bruce Street
ilwaukee 4, Wisconsin

IL TESTING LABORATORIES
Beacon Street
ston, Massachusetts

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drian, Michigan
rsonnel: E. C. Oliver, pres., R. J. ck, secy. & treas.; U. F. Schwartz, pt.

LIVER MACHINERY CO.
25 Clancy Ave., N.E.
rand Rapids 2, Mich.
rsonnel: H. B. Tuthill, plant mgr.; S. Kurkjian, sales mgr.; Herman Ter er, engr.; R. F. Baldwin, adv. mgr.; y Caldwell, designer.

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0 North 12th Street
iladelphia 23, Pennsylvania
rsonnel: Thorsten Y. Olsen, pres. & as.; Tinius Olsen II, vice-pres.; Walter P. Haun, secy.; E. M. Redstreake, sales mgr.; C. Robert Tait, supt. & pur. agent; R. B. Lewis, chief engr.

OLSON DESIGNERS
160 West Walton Street
Chicago 10, Illinois

OLSON PRINTING & PLASTIC COMPANY
1143 Second
San Francisco, California

OMEGA TOOL & DIE WORKS
87 University Street
Seattle, Washington

OMNI PRODUCTS CORP.
40 East 34th Street
New York 16, New York
Personnel: T. Perutz, pres.; F. Breth, vice-pres. & secy.; G. L. Ottens, treas.; Walter Geber, chief engr.; A. Ambes, chg. molding compounds sales; F. M. Marshall, chg. resins sales; Chas. Strauss, chg. molded prod. sales.

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Minneapolis 15, Minnesota
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sonnel: Frank C. Buzzelli, owner.
sses: Compression, 6—30 ton, 1—60

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d, supt. Two Rivers; Geo. J. Platt,
t mgr. Two Rivers; W. J. Aitken,
t engr. Two Rivers; Geo. E. Petrus,
agent Two Rivers.
tory: Two Rivers, Wis.

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sonnel: Allan Rosenthal, treas. &
. mgr.

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roit 14, Michigan
sonnel: Charles S. Marling Jr. &
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Personnel: C. F. Hosford Jr., pres. & gen. mgr.

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Clairton, Pennsylvania

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Long Island City 1, New York

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Personnel: Alvin A. Pereles, pres.; D. M. Stern, vice-pres.; J. A. Pereles, secy.; R. R. Pereles, treas.
Presses: Injection, 7—4 to 8 oz.

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11610 Euclid Ave.
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Personnel: R. J. Minshall, pres.; N. M. Forsythe, vice-pres.; E. S. Moreland, sales mgr.; J. A. Lauck, chief engr.

PETERS CHEMICAL MFG. CO.
3623 Lake Street
Melrose Park, Illinois
Personnel: Peter Glavincheff, owner.

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31 Melbourne
Detroit 2, Michigan

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New York 7, New York

PHEOLL MFG. CO.
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Personnel: E. M. Whiting, pres. & gen. mgr.; J. J. Schwander, secy. & treas.; J. A. Perry, sales mgr.; O. W. Waarich, supt.; F. P. Tisch, chief engr.; N. L. Marvin, adv. mgr.; A. A. Schmid, pur. agent.

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G Street below Erie Avenue
Philadelphia, Pennsylvania

PHILADELPHIA PLASTIC FABRICATORS, INC.
Third and Cambria
Philadelphia, Pennsylvania

PHILIPP BROTHERS, INC.
70 Pine Street
New York, New York

PHILLIPS ELECTRICAL WORKS
Brockville, Ontario, Can.

PHILLIPS & JACOBS
622 Race Street
Philadelphia 6, Pennsylvania
Personnel: Joseph H. Winterburg, gen. mgr.; Thomas J. Garand, pur. agent.

PHOENIX PLASTICS CORP.
Main Street
Clinton, Massachusetts

PHONOGRAPH NEEDLE MFG. CO., INC.
42-46 Dudley Street
Providence, Rhode Island
Personnel: William S. Moody, pres. & plant mgr.; J. H. Moody, secy., treas., adv. mgr. & pur. agent.

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Los Angeles, California

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215 North East Fifth Street
Minneapolis 13, Minnesota

PHOTOSWITCH, INC.
77 Broadway
Cambridge, Mass.
Personnel: A. G. B. Metcalf, pres.; John A. Long, vice-pres.; A. H. Avery, treas.; R. W. Steverman, sales mgr.; L. D. Sibley, plant mgr.; K. G. Colby, adv. mgr.

PICKER X-RAY CORPORATION
300 Fourth Avenue
New York 10, New York

PIERCE & STEVENS, INC.
710 Ohio Street
Buffalo 3, New York
Personnel: Raymond D. Stevens, pres.; Arthur L. Stevens, exec. vice-pres.; S. H. Stilling, vice-pres.; P. P. Dauscher, secy. & treas.; Geo. T. Swing, sales mgr.; D. E. Ellis, chief chem.

PIERCE TESTING LABS.
730 Nineteenth Street
Denver, Colorado
Branch: Pueblo.

PIKES PEAK PLASTICS
5 West Cucharras Street
Colorado Springs, Colo.
Personnel: Egon W. G. Wieselmann, partner & plant mgr.; Florance E. Wiaselmann, partner.

PIONEER MOLD CO.
9227-31 Clinton Road
Cleveland, Ohio
Personnel: Geo. F. Langermeier, owner & gen. mgr.; G. C. Langermeier, supt. & plant mgr.

PIONEER PLASTIC CO.
170 San Fernando Road
Los Angeles 31, California

PIONEER PLASTICS CO.
78 Greene Street
New York, New York
Personnel: Angelo Tomiselli, owner, treas., gen. mgr. & chief engr.

PIONEER PLASTICS CORP.
7 East Balderston Street
Baltimore 2, Maryland

PITKIN, LUCIUS, INC.
47 Fulton Street
New York, New York

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1304 Fifth Avenue
New Kensington, Pennsylvania

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Columbia Chemical Division
Fifth Avenue at Bellefield
Pittsburgh 13, Pennsylvania
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Stevenson and Locust Streets
Pittsburgh, Pennsylvania
Branches: Birmingham, Ala.; Buffa Chicago; Cleveland; Dallas; Detro Greensboro, N.C.; Houston; Indiar polis; Jacksonville, Fla.; Miami; M bile, Ala.; New Orleans; New Yo Philadelphia; St. Louis; Tampa.

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Midland, Mich.
Personnel: David L. Shillinglaw, pre C. R. Overholser, vice-pres.; B. Massee, secy.; John G. McDona treas.; Roland Place, gen. mgr. & ch engr.; William Kienbaum, supt.; Ho ard Stickle, dir. pub. rel. & pur. age
Presses: Extrusion, up to 2½ in.; jection, 8—4 oz., 4—9 oz., 1—16 oz.

PLANO MOLDING COMPANY
113 South Center Avenue
Plano, Illinois
Branch Office: 43 East Ohio, Chicag
Personnel: W. K. Henning, pres. & ge mgr.; Chas. Buckman, vice-pres. sales mgr.; James L. Henning, vic pres.; Gladys R. Seaton, secy. & p agent; Ora Sears Henning, treas.; L. Gregory, supt.; M. E. Lawren chief engr.
Presses: Compression, 2—15 ton, 8— to 150 ton, 1—200 ton, 2—300 ton; jection, 1—4 oz., 1—7 oz., 1—9 o 1—10 oz.

PLA-SAFE PLASTICS CORP.
68 West Huron Street
Buffalo, New York
Personnel: Robert P. Evans, pre treas. & gen. mgr.; Norman J. Tay vice-pres. & secy.; Edward Horow vice-pres.; Howard Becker, plant m

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1263 South Brand
Glendale, California

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Libbey-Owens-Ford Glass Co.
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Toledo 6, Ohio
Personnel: J. L. Rodgers Jr., gen. mg Horton Spitzer, sales mgr.; Les Choyce, adv. mgr.; C. B. Matt, p agent.

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Personnel: R. G. Cheney & J. M. D wyler, partners.
Presses: Injection, 2—1½ oz., 1—6

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2643 South Hill
Los Angeles, California

PLASTELITE ENGINEERING CO
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728 64th Street
Brooklyn, New York
Personnel: Max Herko, pres. & sec R. Herko, vice-pres.; D. J. Wei gen. mgr.

PLAS-TEX CORPORATION
653 North Robertson Boulevard
West Hollywood, California
Personnel: Scott B. Appleby, pres.; Bruce Murchison, secy.; Ray T. Fr exec. vice-pres.; E. B. Horell, treas. gen. mgr.
Presses: Injection, 2—4 oz., 1—6 o 2—8 oz.; Compression, 1—15 ton, 2— ton, 1—150 ton, 1—500 ton.

PLASTEX CORPORATION
402 Mt. Vernon Avenue
Columbus 3, Ohio
Personnel: Orr. S. Zimmerman, T. J. Tully, exec. vice-pres., gen. m & chief engr.; R. O. Zimmerman, vi pres. & supt.; Roy S. Ellison, secy. treas.; R. S. Crane, sales mgr.; P. Rhulman, plant mgr. & pur. age John Stover, adv. agency.
Presses: Extrusion, 1—1 in., 3—2½ i 1—3 in.; Injection, 1—12 oz.

PLASTIC ACCESSORIES, INC.
460 Broome Street
New York, New York
Personnel: G. T. Margolish, pres.; M. M. Lome, gen. mgr.

PLASTIC APPLIANCE CO.
555 North 55th Street
Philadelphia 31, Pennsylvania
Personnel: T. C. Smith, owner.
Presses: Compression, 6—20 ton.

PLASTIC ART TOY CORPORATION OF AMERICA
East Rutherford, New Jersey
Showrooms: Empire State Bldg., N. Y.

PLASTIC BINDING CORP.
732 South Sherman St.
Chicago 5, Illinois
Licensees: All principal cities.
Personnel: Isidore Spinner, pres.; Alfred Smart, secy.; M. M. Rosenfeld, sales mgr.; P. V. Spinner, adv. mgr.; R. J. Jung, pur. agent.

PLASTIC CENTER CO., INC.
209 Mission Street
San Francisco, California
Branch Office: Chicago.
Personnel: Donald E. Fritts, gen. mgr.; Roger D. Fritts, plant mgr.

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Los Angeles 23, California

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Minneapolis 6, Minn.
Personnel: C. A. Nelson, pres.; E. S. Corniea, vice-pres.; Theo. J. Lugowski, secy.; L. R. Nicum, treas.; M. E. Dolan, gen. mgr.

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1220 Huron Road
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Personnel: Richard D. Kidney, owner.

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Los Angeles 7, Calif.
Branch Office: Plastic Molded Products, Inc., 1505 N. Western Ave., Los Angeles.
Personnel: George A. Cooper, pres. & dir. plastics research; Robert A. Cooper, vice-pres., dir. pub. rel. sales & adv. mgr.; Henry Shaefer Jr.; secy.; Robert L. Boughton, treas.; George E. Montgomery Jr., asst. gen. mgr.; Fred Forsman, supt.; Russell Forsman, plant mgr.; Kenneth W. Spillman, chief engr.; George Raub, pur. agent; Allen C. Brooks, finishing supv.
Presses: Injection, 1—2 oz., 3—4 oz., 1—9 oz., 1—12 oz., 1—.

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Los Angeles 15, California

PLASTIC FABRICATORS CO.
440 Sansome Street
San Francisco 11, California
Personnel: I M. Montalto, pres. & pur. agent; M. H. Pringle, secy.; A. E. Lovoi, gen. & plant mgr.

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Boston 11, Massachusetts

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3651-3 West Armitage Avenue
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Personnel: A. Benthaus, pres.; Thomas Clarey, Jr., vice-pres. & secy.; Paul Lipner, sales mgr.

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242 West 36th Street
New York 18, New York
Branch Office: 40 Washington St., W. Orange, N.J.
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Los Angeles 34, California

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Parma, Michigan

PLASTIC MOLD ENGR. CO.
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Detroit 1, Michigan
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Presses: Compression, 1—75 ton, 1—100 ton.

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Personnel: H. Wm. Brandt & Joseph P. Landaver, partners.
Presses: Injection, 2—8 oz., 2—9 oz.

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Presses: Compression, 15—75-400 ton.

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PLASTIC PROCESS COMPANY
662 North Robertson Boulevard
Los Angeles 46, California
Personnel: E. E. Kotkin, owner; H. H. Wenk, gen. mgr.; T. W. Kerr, prod. engr.
Presses: Extrusion, 3—2½ in., 1—3¼ in.

PLASTIC PROCESSES, INC.
2500 Terminal Tower
Cleveland 13, Ohio

PLASTIC PRODUCTS CO.
P.O. Box 384
Massillon, Ohio
Personnel: D. W. Zimonick, owner; Mrs. D. W. Zimonick, treas. & sales mgr.

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South Norwalk, Conn.
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742 North La Cienega
Los Angeles, California

PLASTIC RESEARCH PRODUCTS LABORATORIES
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Personnel: Vance Brand, partner; Ivan Printz, supt.; Walter E. Moore, chief engr.
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Personnel: MacNeel Pierce & N. O. Hulsey, partners; E. H. Long, sales mgr.; Harvey H. Morrison, supt. rubber dept.; D. J. Carr, supt. plastic dept.; Thos. B. Keenan, chief chem.; K. M. Rogers, dir. pub. rel.; George Haugen, supt. tool & die shop; J. S. Reid, pur. agent.
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Kew Gardens 15, Long Island, N.Y.
Personnel: Erwin Flatauer, owner.

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Los Angeles, California

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Leominster, Massachusetts

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Personnel: J. L. Golding, pres. & gen. mgr.; W. H. Comerford, supt.; I. C. Bowman, designer.

PLASTIK, INC.
584 Commonwealth Avenue
Boston, Massachusetts

PLASTI MODE NOVELTY CO.
131 West 28th Street
New York, New York
Branch Offices: 36 W. 20th St.; 390 Second Ave. & 136-138 W. 22nd St., New York.
Personnel: S. Amdur, owner; Melan Gabriel, supt.

PLASTIMOLD, INC.
Attleboro, Mass.
Personnel: H. J. Sobiloff, pres.; M. N. Sobiloff, vice-pres.; M. J. Regan, secy.; F. L. Daylor, treas. & gen. mgr.; Birger Stenberg, sales mgr. & dir. plastics research; John Stenberg, supt. & pur. agent.

PLASTIQUES RESEARCH, INC.
5248 North Clark Street
Chicago 40, Illinois
Personnel: E. Douglas de Gruchy, pres.; Warren Wright, vice-pres.; Margaret Aldrich, secy.; E. M. Hylton, gen mgr.; A. W. Klein, plant mgr.

PLASTITE ADHESIVE CEMENT COMPANY
800 North Clark Street
Chicago 10, Illinois
Personnel: Charles Conner, owner.

PLASTITOOL ENGINEERING CO.
626 North Robertson Boulevard
Los Angeles 46, California

PLASTOFILM, INC.
916 West Union Avenue
P.O. Box 531
Wheaton, Illinois
Personnel: Max Benaroy, pres. & gen. mgr.; Vera Weiss, vice-pres.; George Weiss, secy., treas., plant mgr. & chief chem.

PLASTOLITE COMPANY, THE
West Chester, Pa.

PLASTOMATIC CORPORATION
392 West Lancaster Avenue
Wayne, Pennsylvania
Personnel: Thomas E. Betner, pres.; George H. Parsons, vice-pres.; Joseph R. Townsend, secy.; Frederick W. Marshall Jr., treas.

PLATING PROCESSES CORP.
109 Lyman Street
Holyoke, Massachusetts
Personnel: Fred W. Hampson, pres. & treas.

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133 Walnut St.
Hartford, Conn.
Personnel: F. Goodwin Smith, pres.; A. T. Safford, Jr., vice-pres. & gen. mgr.; A. S. Hampson, asst. treas.; James O. Burgess, acting sales mgr.; G. C. Heldrich, plant mgr.; Walter M. Brash, pur. agt.

PLEXON, INC.
212 Fifth Avenue
New York 10, New York
Plant: Greenville, S. C.
Personnel: N. J. Strauss, vice-pres.

PLOMB TOOL COMPANY
Box 3S19 Terminal Annex
Los Angeles 54, California

PLYMOLD CORPORATION
Lawrence, Massachusetts
Personnel: Paul R. Goldman, pres., treas. & gen. mgr.; Irving Nager, vice-pres. & plant mgr.; Harry Steinberg, secy.; J. Leonard Michelson, dir. pub. rel., sales & adv. mgr.; Andrew Alvino, supt.; M. Stearn, pur. agent.

PLYMOUTH ORGANIC LABS.
(M. W. Parsons, Imports)
59 Beekman Street
New York, New York
Distributors: All principal cities.
Personnel: Herbert Bye, pres.; Ernest C. Schmidt, tech. sales mgr.; Richard Olsen, plant mgr.; Wilbur Young, chief chem.

PLY-TEX MFG. CORP.
129 West 22nd Street
New York, New York

PLYWOOD PLASTICS CORP.
Bay City, Michigan

POINSETTIA, INC.
Cedar Avenue
Pitman, New Jersey
Personnel: E. P. Carter, owner.

POLARAY COMPANY
248 West 23rd Street
New York 11, New York
Personnel: Raymond Mark, pres.; Ruth Polak, secy. & treas.
Presses: Compression, up to 250 tons.

POLAROID CORPORATION
Cambridge 39, Massachusetts
Personnel: Edwin H. Land, pres.; Richard T. Kriebel, secy.; C. P. Fuller, treas.; Walter Lown, gen. mgr.; Otto Wolff, chief engr.; Wil Marcus, adv. mgr.; Paul Sullivan, acting pur. agent.

POLINER, WILLIAM
252 East 61st Street
New York 21, New York

POLY RESINS
2348 East Eighth Street
Los Angeles 21, California
Personnel: Claus H. Vonder Reith, pres.; Wm. F. Vonder Reith, vice-pres.; Alfred E. Messerly, secy. & chief chemist; F. C. Beyer, treas. & gen. mgr.; Carl L. Hill, sales mgr.

POLYPLASTEX
92-35 Horace Harding Boulevard
Elmhurst, Long Island, New York
Personnel: H. W. E. Riley, owner; M. I. Harriman, secy.; Stephen Dragotta, plant mgr.; Fred Gruenwald, chief chemist; Richard H. Malamphy, dir. of development.

POMONA MACHINE WORKS
163 East Commercial Street
Pomona, Calif.

POND ENGINEERING CO.
15 Park Street
Springfield, Mass.
Personnel: K. H. Pond, pres.; E. S. Stedman, treas. & sales mgr.; D. B. Shepherd, pur. agent; M. J. Warwick, supt.

POPULAR PLASTIC PRODUCTS
Northport, New York

PORTABLE PRODUCTS CORP.
C. J. Tagliabue Division
550 Park Avenue
Brooklyn 5, New York
Branch Offices: Old South Bldg., Boston; 608 S. Dearborn St., Chicago; 5902 Carnegie Ave., Cleveland; 810 Main St., Dallas; 2832 E. Grand Blvd., Detroit; Railway Exchange Bldg., St. Louis; 120 Main St., San Francisco; 2137 Second Ave., Seattle.
Personnel: G. A. Terhune, adv. mgr.; J. H. Nichols, pur. agent; E. D. Wacker, gen. mgr.; A. G. Koenig, sales mgr.

PORTAL PRINTING AND PLASTIC COMPANY
300 Broadway
San Francisco, California
Personnel: Mylo G. Cox, partner, secy. & treas.; Tom F. Hislop, partner, gen. & plant mgr. Harry H. Deurloo, supt.

PORTER, C. O., MACH. CO.
666 Front Avenue, Northwest
Grand Rapids 4, Michigan

PORTER-CABLE MACHINE CO.
1609-11 North Salina Street
Syracuse 8, New York

PORTER, H.K. COMPANY, INC.
1932 Oliver Building
Pittsburgh 22, Pennsylvania
Branch Offices: Boston; Buffalo; Chicago; Cincinnati; Detroit; Los Angeles; Newark, N.J.; New York; Philadelphia; San Francisco; Washington.
Personnel: T. M. Evans, pres.; W. W. Calihan, sales mgr.; H. J. Zukauskas, adv. mgr.

POST & JOHNSON, INC.
71 Church Street
Hartford, Connecticut

POSTE, EMERSON P.
309 McCallie Avenue
Chattanooga, Tennessee

POTTER & BRUMFIELD MFG. CO., INC.
617-21 North Gibson Street
Princeton, Indiana

POUX, NOEL J., LAB.
Morgan Street
Meadville, Pennsylvania

POWER KING TOOL CORP.
Warsaw, Indiana
Personnel: J. H. Penniman, pres.; A. R. Eichelberg, secy. & treas.; L. H. Russell, sales mgr.; W. Lowman, plant mgr.

POWHATAN MINING CO.
6721 Windsor Mill Road
Baltimore, Maryland
Personnel: Fred A Mett, pres. & gen. mgr.; Charles Silver, secy.; E. L. Farley, treas.

PRACTICAL PLASTICS, INC.
615 Broadway
Daytona Beach, Florida
Personnel: Keith Vining, pres. & gen. mgr.; Hilmer F. Sander, vice-pres.; Elizabeth C. Reid, secy. & treas.; Ed. J. Kirst, sales mgr.; C. L. Vining, supt.

PRATT & WHITNEY
Division Niles-Bement-Pond Co.
1 Charter Oak Boulevard
West Hartford 1, Connecticut

PREBLE, HARRY JR.
104 East 40th Street
New York 16, New York
Personnel: Harry Preble, Jr., owner; H. M. Preble, gen. mgr.; E. O. Eblovi, chief designer.

PRECISE PRODUCT COMPANY
1351 Clark Street
Racine, Wisconsin
Personnel: H. W. Schumann, gen. mgr.; Rob. Schmann, chief engr.

PRECISION DESIGN SERVICE
62 Eighth Avenue
Newark 2, New Jersey

PRECISION ELECTROTYPE CO.
1045 Sansome Street
San Francisco 11, California

PRECISION FABRICATORS, INC.
Box 270
East Rochester, New York

PRECISION MOLD CO.
5505 West Montrose Avenue
Chicago 41, Illinois
Personnel: Stephen J. Handzel, pres. & chief engr.; Geo. L. Knaak, vice-pres.; Helen H. Wielgus, secy. & pur. agent.

PRECISION MOLDED PLASTICS
2014 West 53rd Street
Cleveland 2, Ohio
Personnel: G. Gildersleeve, gen. mgr.
Presses: Injection, 1—8 oz., 1—12 oz., 1—16 oz.

PRECISION PLASTIC PROD. CO.
1451 West Van Buren Street
Chicago, Illinois

PRECISION PLASTICS
3019 Casitas Avenue
Los Angeles, California

PRECISION PLASTICS CO.
4655 Stenton Avenue
Philadelphia, Pennsylvania

PRECISION PRODUCTS CO.
165 North Broadway
Milwaukee 2, Wisconsin

PRECISION SCIENTIFIC CO.
1736 N. Springfield Avenue
Chicago 47, Illinois
Branch Office: Packard Bldg., Philadelphia.
Personnel: W. W. Pitann, pres. & treas., A. I. Newman, vice-pres.; A. Pitann, secy.; D. A. Delve, plant mgr.; H. H. Bashore, dir. plastics research; J. H. Schultheis, adv. mgr.; E. R. Tetzner, dir. of purchases; J. P. Duray, dir. of prod. engineering; R. H. Eddy, personnel mgr.; L. C. Short, dir. of research engineering; W. Von Guilder, dir. of design engineering.

PRECISION SPECIALTIES
210-220 North Western Avenue
Los Angeles 4, Calif.
Branch Offices: 20 E. Jackson Blvd., Chicago; 366 Fifth Ave., New York.
Personnel: L. H. Glaser, partner & gen. mgr.; Joseph Raeburn, partner & sales mgr.; H. M. Washburn, supt.; M. R. Roberts, chief engr.; Paul C. Gatov, comptroller; C. L. Gould, pur. agent; Hillman-Shane-Breyer, Inc., advertising agency.
Presses: Injection, 1—12 oz, 2—8 oz.

PRECO, INC.
960 East 61st St.
Los Angeles 1, Calif.
Personnel: C. T. Hill, pres.; H. J. Wieden, vice-pres. & gen. mgr.; C. R. Nissen, secy. & treas.; E. F. Stoner, chief engr.; Ed. Zuchelli, sales mgr.

PREIS, H. P. ENGRAVING MACHINE CO.
155 Summit St.
Newark 4, New Jersey
Personnel: E. J. Preis, partner & gen. mgr.; M. H. Preis, partner; A. M. Malloy, sales mgr.; J. A. Hoffman, plant mgr.

PREIS, MARION
177 East Eighty-seventh Street
New York, New York

PREMIER ENGINEERING SUPPLIES LTD.
66 Dundas St., W.
Toronto, Ontario, Canada

PREMIER TIP PRINTING CO.
752 Broadway
New York 3, New York
Personnel: Samuel Hader, owner.

PREPAC
29 West 26th Street
New York 10, New York
Personnel: Herman Jacobson, owner; Ernest Holden, mgr.

PRESCO PLASTICS
3045 North 28th Street
Milwaukee, Wisconsin
Personnel: E. K. Schroeter, owner.

PRESQUE ISLE PLASTICS, INC.
2730 West 12th Street
Erie, Pennsylvania
Branch Office: Wills Plastic & Engr. Co., NBC Bldg., Cleveland, Ohio.
Personnel: W. J. Phillips, pres.; C. J. Denmark, vice-pres.; K. A. Rouzer, gen. mgr.
Presses: Injection, 2—4 oz., 1—9 oz., 3—12 oz.

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Preston, Ontario, Canada

PREYER, RUTH
90 Chestnut Street
Brooklyn, New York

PRICE, M. B. ASSOCIATES
Empire State Bldg.
New York, New York
Personnel: M. B. Price, owner.

PRINCE INDUSTRIAL PLASTICS
7400 Stanton Avenue
Cleveland 4, Ohio
Personnel: Warren V. Prince, pres. & chief engr.; Wm. W. Cox, secy-treas.; Lawrence E. Martoni, supt.; Frank R. Helfrich, sales mgr.
Presses: Injection, 1—8 oz, 1—1 oz; Compression 1—30 ton; Compression & transfer, 2—120 ton, 1—113 ton.

PRINTLOID, INC.
93 Mercer Street
New York 12, New York
Personnel: G. Margolish, pres.

PRINTON CORPORATION
304-310 East 23rd Street
New York, New York
Personnel: Dr. Marc B. Golandsky, pres.; Lew B. Golandsky, vice-pres.; Leo Holland, secy.; Charles Breyner, treas.

PRIORITY DIE SINKING CO.
479 Wellington Street, West
Toronto, Ontario, Canada

PRO MANUFACTURING CO.
408 East 21st
Paterson, New Jersey

PROBAR CORP.
Berkeley Heights, New Jersey

PROCTER & GAMBLE CO., THE
Gwynne Building
Cincinnati 1, Ohio
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PROCUNIER SAFETY CHUCK COMPANY
18 South Clinton Street
Chicago 6, Illinois
Personnel: H. G. Procunier, pres.; J. A. McConnell, secy.

PRODUCT DESIGNERS
230 North Michigan Avenue
Chicago 1, Illinois
Personnel: W. C. Nichols, mg. dir.

PRODUCT DEVELOPMENT & DESIGN
3603 Lancaster Ave.
Philadelphia 4, Pa.
Personnel: Arthur Wilson, dir.

PRODUCT ENGR. & MFG.
3709 West Armitage Avenue
Chicago 47, Illinois
Personnel: James A. Boyajian, pres., treas. & dir. plastics research; C. L. Krueger Jr., vice-pres.; Eleanor Boyajian, secy.; C. L. Krueger, gen. mgr.

PRODUCT ENGINEERING & TOOL DESIGN CO.
35 Union Place
Irvington, New Jersey
Branch Office: 18th St. & Avon Ave., Newark, N.J.
Personnel: Hugo Schlenker, owner.

PRODUCT TECHNICIANS, INC.
65 Broad St.
Rochester 4, New York
Personnel: Chester W. Crumrine, pres.; Herbert E. Crumrine, vice-pres.; Mrs. Grace W. Crumrine, secy-treas.

PRODUCTION MACHINE CO.
Greenfield, Massachusetts
Personnel: A. H. Behnke, pres. & treas.; C. F. Pickhardt, vice-pres.; Burt Greenwood, supt.; R. W. Fuller, chief engr.; Percy West, pur. agent.

PRODUCTIONEERING ASSOC.
526 West State Street
Rockford, Illinois
Personnel: J. O. Olsen, pres.; I. G. Bentley & P. N. Dunham, partners; L. J. Safford, gen. mgr.; Fred A. Foth, chief engr.; J. E. Morris, sales engr.; Arthur C. Haggstrom, dir. product design.

PRODUCTS MFG. CO.
4558 Council
Los Angeles, California

PROGRESS SMELTING & REFINING CO.
83-85 Walnut Avenue
Toronto 2B, Ontario, Canada

PROGRESSIVE INDUSTRIES
Ross Park
Benton Harbor, Michigan
Personnel: David J. Ross, partner, gen. & sales mgr.; Theodore Loew, chief engr. & dir. plastics research; Gertrude Ross, dir. pub. rel.; Ted Lewis, pur. agent.

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Presses: Injection, 1—4 oz., 5—8 oz., 12—12 oz., 10—16 oz., 3—22 oz., 4—24 oz.; Compression & transfer, 8—15 ton, 5—75 ton, 24—100 ton, 7—200 ton; Extrusion, 3—2½".

PROTECTIVE COATINGS, INC.
Box 3985
Detroit 27, Michigan
Branch Offices: Protective Coating & Supply Co., 65 Stephen Ave., New Hyde Pk., Long Island, N.Y., John M. Shea, Box 109, Bell, Calif.
Personnel: H. Tom Collord, pres. & treas.; L. E. Collord, vice-pres.; F. E. Collord, secy.

PROTECTO PHOTO COMPANY
2 Broadway
New York 4, New York

PROVIDENCE ELECTRO-PLATING CO.
11-13 West Thirtieth Street
New York 1, New York

PURDY, W. S., CO., INC.
128 Water Street
New York, New York

PULVERIZING MACHINERY CO.
Chatham Road
Summit, New Jersey
Personnel: Louis Ruprecht, prop.; F. E. Oswald, dir., adv. & sales mgr.; C. D. Burtenshaw, dir. & chief engr.; C. W. Ruprecht, dir. & pur. agent.; F. Arnold, supt.

PUTNAM TOOL COMPANY
2981 Charlevoix Avenue
Detroit 7, Michigan

PUTNAM TOOL & DIE CO.
Cambridge, Ohio
Personnel: E. J. Riehl, gen. mgr.

PYCOLITE PLASTICS CORP.
248 West 23rd Street
New York 11, New York
Personnel: Raymond Marks, pres.; Ruth Polak, secy. & treas.
Presses: Compression, up to 250 tons.

PYRAGLASS, INC.
South Robinson Avenue
Newburgh, New York

PYRENE MFG. CO.
560 Belmont Avenue
Newark 8, New Jersey

PYRO PLASTICS COMPANY
526 North Avenue, East
Westfield, New Jersey
Personnel: Wm. M. Lester, partner, sales mgr. & chief engr.; Wm. M. Shapiro, gen. & plant. mgr.; B. LaBelle, supt.; B. L. Lester, pur. agent.
Presses: Injection, 2—4 oz., 3—6 oz., 1—8 oz., 2—16 oz.

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103 LaFayette Street
New York 13, New York

PYROXYLIN PRODUCTS, INC.
4851 South St. Louis Avenue
Chicago 32, Illinois

QUAKER OATS COMPANY
141 West Jackson Boulevard
Chicago 4, Illinois
Personnel: R. Douglas Stuart, pres.; R. E. Coon, secy.; L. F. Watermulder, treas.; Lauren B. Hitchcock, mgr. chem. dept.; F. N. Peters, dir. plastics research.

QUALITY DIE & MOULD CO.
11864 Evanston
Detroit, Michigan

QUARNSTROM TOOL CO.
6698 E. McNichols
Detroit, Michigan

QUINN BERRY CORPORATION
2601 West 12th Street
Erie, Pennsylvania
Personnel: Jas. P. Quinn, pres. & sales mgr.; L. L. Berry, secy. & treas.
Presses: Injection, 3—8 oz.

R. & C. PLASTIC PRODUCTS
489 Plainfield Street
Providence 9, Rhode Island
Branch Offices: 349 Manton Ave., Providence; 208 Park Ave., Woonsocket.
Personnel: Joseph H. Raymond, co-owner, gen. & personnel mgr.; Joseph A. Cyr, co-owner.
Presses: Compression, 2—35 ton.

R. C. A. VICTOR CO. LTD.
1000 Lenoir St.
Montreal, Quebec, Canada

R. P. M. COMPANY
1245 Seventh St.
Denver 4, Colo.
Personnel: R. P. McClurg, owner.

RACINE TOOL & MACHINE CO.
1760 State St.
Racine, Wisconsin
Personnel: M. E. Erskine, pres.; F. H. Kind, vice pres. & chief engr.; J. E. Erskine, secy.; H. A. Schultz, sales mgr.; William Carlson, plant mgr.; H. C. Smith, pur. agt.

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Presses: Compression, 5B; Injection, 6.

RADIO FREQUENCY LABS.
Boonton, New Jersey

RADIO RECEPTOR CO., INC.
251 West 19th Street
New York 11, New York

RADIOLITE MFG. CO.
810 S. Gallatin Street
Jackson, Mississippi
Personnel: Harold Davis, owner; C. W. Avwarter, chief engr.; Ralph W. Emerson, plant mgr. & pur. agent.

RAE, J. FRASER
3807 Harrison Street
Oakland, California

RAINBOW PLASTIC LIMITED
P.O. Box 383
Ottawa, Ontario, Canada

RAND RUBBER COMPANY
397 Sumner Avenue
Brooklyn, New York
Personnel: LeRoy H. Rand, pres. & treas.; Edward M. French, vice pres. & supt.; Peter J. Scheidt Jr., secy.

RANGER TENNERE INC.
450 W. Thirty-first St.
New York, New York
Personnel: A. S. Bing, pres.; Saul Optner, vice pres. & plant mgr.; S. H. Berman, secy.; M. Dolan, treas.; Ludwig Geist, supt.; Paul Wartheimer, chief engr.; R. T. MacAllistar, sales mgr.; Herbert Bodkin, pur. agt.

RATHBUN MOLDING CORP.
290 Rochester Street
Salamanca, New York

RAYBESTOS-MANHATTAN, INC.
Asbestos Textile & Packing Div.
Manheim, Pennsylvania

RAYBESTOS-MANHATTAN, INC.
Manhattan Rubber Division
61 Willett Street
Passaic, New Jersey

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St. Paul, Minnesota
Branch Offices: 5BB Peachtree St., Atlanta; 714 S. Hill St., Los Angales; 47 East 51st St., New York.
Personnel: Raymond E. Lea, pres., treas. & gen. mgr.; Mark L. Arend, vice-pres.; Stanley C. Watson, vice-pres. & dir. plastics research; Stanley C. Watson, vice-pres. & chief engr.; Raymond E. Reed, vice-pres. & chief chemist; Al Le Duc, adv. mgr.; Robert J. Shapiro, pur. agent.
Presses: Compression, 3—100 ton, 1—200 ton, 2—50 ton, 2—30 ton, 1—20 ton.

RAYMOND PULVERIZER DIV.
Combustion Engineering Co., Inc.
1319 North Branch Street
Chicago 22, Illinois

RAYON PROCESSING CO. OF RHODE ISLAND
86 Tremont Street
Central Falls, Rhode Island
Personnel: Marman E. McCulloch, pres.; C. Stanley Kinney, vice-pres.; Oman G. Thayer, secy., gen. mgr. & pur. agent; Wm. McCulloch, treas.; J. B. Dow, supt.; M. A. Foley, sales mgr.; Arthur Goodwin, chief engr.; J. B. Cutler, dir. publ. rel.

READ MACHINERY CO., INC.
York, Pennsylvania
Personnel: James T. Duffy Jr., pres.; Theodore F. Freed, vice-pres.; LeRoy W. Sipe, treas.; John I. Spangler, supt.; A. K. Brennan, sales & plant mgr.; John M. Gaffney, chief engr.; James G. Keuster, adv. mgr.; C. W. Ness, pur. agent.

READING CHAIN & BLOCK CORPORATION
2100 Adams Street
Reading, Pennsylvania

READING PRATT & CADY DIV.
American Chain & Cable Co.
Reading, Pennsylvania
Personnel: See American Chain & Cable Co., Inc.

REICHHOLD CHEMICALS INC.
601 Woodward Heights Blvd.
Detroit 20, Michigan
Branch Offices: Brooklyn; Elizabeth, N.J.; San Francisco; Tuscaloosa, Ala.
Personnel: H. H. Reichhold, owner & chmn. of the board; C. O'Connor, pres.; P. Ryan, K. Haven, Dr. C. A. Kraus & Dr. Baum, vice-pres.; P. Swisher, vice-pres. & sales mgr.; A. G. Goetz, secy.; F. Grosius, treas.; C. Jarl, chief engr.; Harry Kline, mgr. & tech. dir. phenolic plastics div.; O. R. Stewart, pur. agent.

RECTO MOLDED PRODUCTS
Appleton & B. & O. Railroad
Cincinnati 9, Ohio
Personnel: N. A. Backscheider, pres., treas. & gen. mgr.; Frank Harvey, secy.; H. Barker, supt.; Q. Fisher, chief engr.
Presses: Compression, 50—70 to 200 ton; Injection, 4—4 to 8 oz.

REED, ROWENA
228 East 61st Street
New York 21, New York

REED-PRENTICE CORPORATION
677 Cambridge Street
Worcester 4, Massachusetts
Branch Offices: 1213 W. Third St., Cleveland; 75 West St., New York.
Personnel: F. W. McIntyre Sr., pres. & gen. mgr.; C. S. Payson, vice-pres. & treas.; E. T. Connolly, secy.; R. L. Rougemont, chief engr.; R. P. Harrington, pur. agent; E. J. Keyes, plant mgr.; C. Larson, supt.; F. W. McIntyre Jr., asst. to pres.; D. H. Dalbeck, controller; V. Rosenlund Sr., prod. mgr.

REGAL PLASTIC CO.
708-716 Main St.
Kansas City, Missouri
Branch Office: 121 W. Wacker Dr., Chicago.
Personnel: Jerome S. Kivett & Homer I. Benson, partners.

REILLY TAR & CHEM. CORP.
1617 Merchants Bank Building
Indianapolis 4, Indiana
Branch Offices: Buffalo; Chattanooga; Chicago; Cleveland; Los Angeles; Mobile; New York.
Personnel: P. C. Reilly, pres.; P. C. Reilly Jr., vice-pres.; R. J. Wechsler, secy. & treas.; William Higburg, gen. & sales mgr.; R. T. Bogendief, supt.; H. R. Horner, chief engr.; F. E. Cislak, dir. plastics research; J. H. Davidson, adv. mgr.; S. C. Boyle, pur. agent.

REIN, WALTER
1680 N. Vine St.
Los Angeles 28, California
Studio: 5404 Sierra Vista, Los Angeles.
Personnel: Walter Rein, ownar.

REINHOLD, F. E., MFR.
7001 McKinley Avenue
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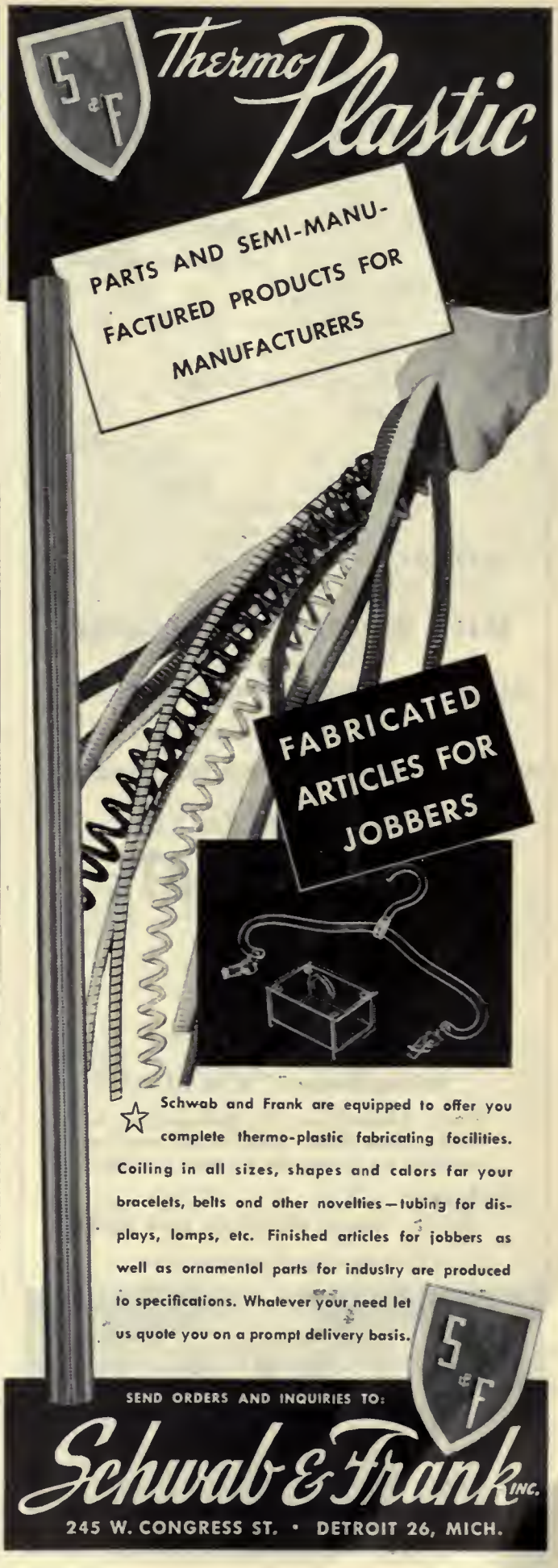
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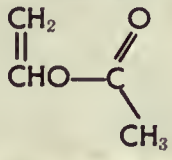

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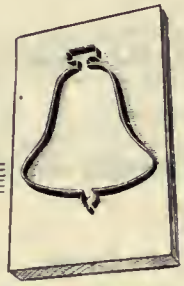

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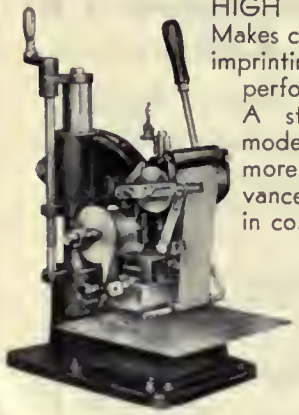

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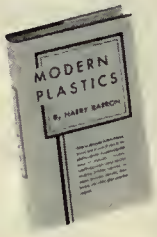

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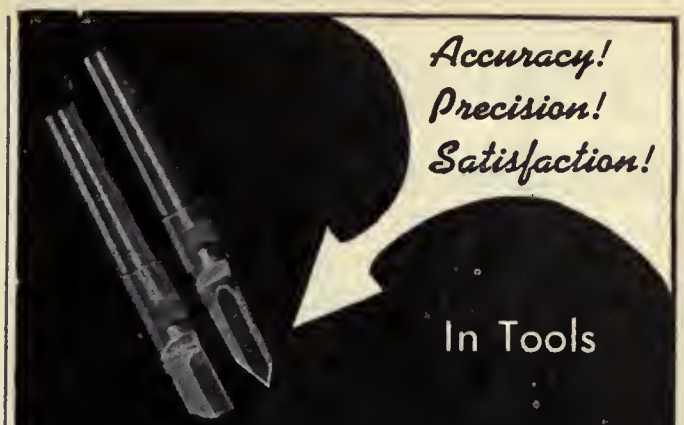

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tergents, common solvents, etc. The machine is portable, has a power consumption of 10 w, and is said to be suitable for continuous duty. The entire electronic system is shielded and enclosed in a metal housing; and no batteries or transformers are required.

A precision machine for compression and transverse testing, the *Dillon Universal Tester* will handle round, flat or special plastics shapes and requires no special training to operate. It is suitable both for laboratory or production line use, and is available with a large assortment of accessories, including seven interchangeable dynamometers ranging from 250 to 10,000 lb capacity. It weighs 132 lb and stands 5′ 7½″. It is also available in extra tall special purpose models. Delivery may be had in 18-21 days on the standard models and 21-26 days on the specials.

Televac MR and *S* are two recording instruments developed by Precision Scientific Co., Chicago, for measuring ultra vacuum. Type *MR* has a range of 0-500 microns. Features include coated filaments to prevent "off calibration" periods due to water, oil vapor or other contaminating vapors; increased sensitivity gained through the use of two filaments in both standard and variable tubes of the vacuum gage; and interchangeability of gages without recalibration.

A machine permitting fluorescent penetrant inspection of molded plastics parts to find cracks formed during molding, cooling or ageing processes has recently been announced by Magnaflux Corp., Chicago. Parts to be inspected are placed in wire baskets and then immersed in a special penetrant. Examination under near-ultra violet light then reveals the cracks as bright lines of greenish yellow fluorescence. The latest model of this inspection device is the *ZA-12 Zyglo Unit*, which is suitable for inspection of small plastics parts in moderate quantities.

Miscellaneous Machines

Fast-setting resin glues may be applied economically and without dead spots to the edges of lumber with a single-roll spreader produced by Charles E. Francis Co., Rushville, Ind. Designed primarily for plywood manufacture, this machine may be used with a variety of liquids and semi-liquids. The machine has easily removable seal plates to prevent glue from running out and is run by a ¼ hp, 110 v or single-phase motor with gearing to give a roll speed of 38 rpm or 55 fpm.

The Watson-Stillman automatic tableting machine was introduced in 1945 as a preformer of general purpose and semi-impacted materials. This machine is entirely self-contained with motor, radial-piston type pump, valves, controls and tank used in the base of the machine. Removable covers make all power equipment accessible for adjustment and maintenance. The press may be operated fully automatic or semi-automatic, since all moving rams and the feeder can be operated manually, independent of each other. Capacity of the machine is 100 tons, its maximum stroke 7½″, height 9′ 2″, floor space required 4′ 14¾″ by 3′ 11⅝″ and its shipping weight is 10,500 lb. It has a capacity of up to 12 cycles per minute, depending on thickness of pill and material preformed.

The *Acromark 9AHS* (Acromark Co., Elizabeth, N. J.) is described as being widely adaptable to the marking of cylindrical and tubular plastics parts "which require a particularly prominent or attractive marking." Using the hot stamping principle through pigment transfer tape, the construction of the machine is said to make possible a clear mark without breakage of brittle plastics.

Newly developed, the *American KC* rotary knife chopper (American Pulverizer Co., St. Louis) is said to make possible the uniform granulation of thermoplastics scrap for uniform mold flow in a "once-through," fast, single operation. Designed to be of use wherever reclamation of

scrap is desired, this machine reduces cellulosics, styrenes, acrylics, polyethyls, butyrates and vinyls, yet maintains control of granule size even if the product softens at temperatures as low as 40° to 50° C, and offers no production problem regardless of nature, size or shape of thermoplastics fed to it. Capacity is 200 to 400 lb per hr and floor space requirements 36″ by 72″.

The *Sav-Way Heat Sealer* (Sav-Way Industries, Detroit) is a small, compact sealer which produces an airtight, moisture-proof welded closure. It is adaptable to a wide variety of packaging films and foils and to a large variety of packaging methods. The sealing head may be tilted in a 90° arc so that an operator may easily hand feed all different sizes of light packages. The head may also be mounted on a monorail to facilitate the sealing of large containers such as complete airplane engine bags. END

The Buyer Says
(*Continued from page* 60)

phenolic recently introduced by Chen Yu into its *Cloud Silk* line (see p. 58). A Dorothy Gray lipstick and an Elizabeth Arden lipstick and powder base case are also shown, along with the Gourielli lipstick (see p. 60).

Such combinations of plastics and metal offer beauty and functional design in lipsticks—brass for the mechanism of the base and plastics for rich effects not to be achieved in metal. Whether alone or in combination it is safe to say that plastics will remain in the lipstick market because of the luxury and femininity they add and the opulent color that withstands the chipping of painted metal.

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ject to three complaints. First, the swivel did not work smoothly because the material developed friction. (This was usually the customer's complaint.) Second, dimensionally unstable materials were used, of necessity, causing shrinking and swelling; thus caps fell off in shipment ruining large numbers of lipsticks on which the manufacturer had to make good. The third ground of complaint was sweating of the lipstick caused by water absorbent material, but this was relatively less important.

Hasty design also impaired the war-time lipstick case. Insufficient attention was given to a locking device for the plastics cap, and some all-plastics cases are still being molded without the nibs or lances generally used in metal cases to hold the cap snugly. Most all-plastics cases, however, have now introduced nibs or other locking device. A push-up mechanism greatly simplifies the all-plastics case, but push-ups are not generally popular in this country, though some few are widely sold, among them Pond's and Kampa Plastics' *Stadium Girl,* both favorites in the ten-cent stores.

Compacts Are Popular

Much the same story is true of compacts. Metal compacts in gold and silver now offset the lean years when metal was absent from the scene, and plastics compacts are said to be "out."

But in an appraisal of style trends, it should be remembered that plastics introduced the most popular compact of all time, the tortoise shell pancake. Throughout the war the tortoise shell pancake was universal, ubiquitous, molded by multitudinous molders (usually of cellulose acetate), and sold at various prices. A national brand such as *Volupté* sold in department stores at about $3 for a large, five-inch compact.

Variations of the pancake appeared in color, one of the most notable being the *Ziegfeld Girl* at $3 and its smaller companion, *Pony Girl,* at $2, which were best sellers in most of the stores canvassed. (Both are molded of cellulose acetate.) Allied Plastics, the manufacturer of these compacts, plans to continue these identical compacts, bringing them out each season in high-style colors; thus the 'penny copper' predicted for this spring already has its matching *Ziegfeld Girl* compact.

Methyl methacrylate compacts selling at $5 to $10 in department stores were not usually best sellers because of their price differential, though many individual compacts such as Bell's sold well. Two popular-priced molded compacts have recently been introduced—Maveo's charming compacts in jewel tones or Sandwich glass design, and Allied Plastics' new *Zodiac* compact which can be chosen in twelve different decorative plaques.

Warping, hinges and clasps were general complaints in the war-time compacts. Hinges are now usually satisfactory, except where inadequate pins are used, but warping continues to be a difficulty in compacts molded of the less stable materials. Warping of the case allows the powder to seep out, and seepage is also caused by improper designing of very shallow wells without bezeled rims.

Clasps had improved in recent months and many compacts had been fitted with metal clasps, preferred by buyers. The plastics fold-over clasp is also satisfactory if made with a long enough lip to prevent loosening.

Brushes and Combs

Plastics brushes and combs have so successfully ousted competition that there is little to say about them in this discussion. Though some hard rubber combs will return, plastics—vinyls, cellulose acetate, polystyrene, methyl methacrylate—have largely absorbed the field and will remain in it.

Brushes, too, are staple merchandise always in demand.

Metal-conscious as the public is at the moment, it is only plastics- and nylon-conscious in the brush market. Methyl methacrylate brushes were much in demand at Christmas at prices from $1.50 up (in moderate priced stores) while cellulose acetate brushes retailed at somewhat lower prices. Cast phenolic had not yet returned except in "scrubs."

"Trend" Toward Metal

The present "trend," as it is called, toward metal might with more propriety be called a "vogue" since it is purely a style trend induced by scarcity. Once the novelty of a plentiful supply wears off, metal can scarcely maintain its present style prestige.

Although faulty design and misapplications did occur under the duress of military requisitioning of plastics, such consumer prejudice as may have arisen, appears to be of minor importance. On the whole, consumers are impressed with the performance of plastics, in war as in peace. The splendid publicity done on behalf of methyl methacrylate, for instance, and its equally splendid performance, have convinced the public that here is a superior material. Only price stands in the way of consumer sales. In a less degree this is true of all plastics.

Speaking generally, the plastics industry may well congratulate itself on the caliber and acumen of its molders, on their maintenance of a far-sighted policy of good merchandise even in the stress of war, and on the agility with which they have turned from war to peace, surmounting almost insuperable difficulties of supply and labor to produce wanted merchandise.

Ingenious molders have been quick to see an advantage in the release of other materials, and to seize the possibili-

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ties inherent in combinations of plastics with metal, with glass or with other materials. Of such innovations are styles made. Recognizing as they do that style fads are arbitrary and changeable, they have yet adapted themselves to style edicts of the moment, to color conventions and that new touch in design which makes a best seller.

Buyers, like consumers, appreciated the remarkable achievement of molders in designing new merchandise amid the harassments of war. They were interested in the future possibilities of plastics, and they had many concrete suggestions for new applications, such as the metallized toys illustrated. One buyer who had seen Uttley's artistic work asked whether you could get "that beautiful bubble plastic yet."

In brief, then, despite the momentary style prestige of metal, the world is starved for the variety of artistic design and the opulence of color inherent only in plastics. END

NOTE: In the preparation of this article, the following syndicates were interviewed: Woolworth (1800 to 2000 stores); Kress (280 stores); the AMC department store syndicate (23 department stores, such as Filene's, Boston, Hudson's, Detroit, L. S. Ayres, etc.); and Allied Stores (69 stores). In addition, buyers from various departments of Gimbel's, Macy's, Altman's, Lord and Taylor, Sak's Fifth Avenue, Lewis and Conger, Kress, Fifth Avenue, and Woolworth (three metropolitan stores) were interviewed, as well as many individual sales clerks. Buyers or designers for Rubinstein's, Gourielli, Elizabeth Arden, Dorothy Gray (Lehn and Fink), and Germaine Monteil also advised.

Photograph on page 53 by Acme Newspictures, Inc.

The Molder Has His Problems

(*Continued from page* 68)

phenolic having low water-absorption. It proved entirely satisfactory and no warping or cracking followed repeated washings.

Often it is not the material itself but the molding technique that spells the difference between success and failure of end-product use.

During the war, the Quartermaster ordered mess kit knives with phenolic (Rogers board) handles. These at first lacked durability. Investigation showed it was not the plastics but the molding that was the source of the difficulty. The molding process was modified with a change in pressure, and the trouble disappeared.

One quality of the product influenced by the particular molding technique used is surface appearance. In some cases, an undesirable "dog-skin" texture results from compression molding of flat surfaces. This can be eliminated by chilling the hot material before ejection from the mold. However, this process takes added time and delays production, so the molder must balance the time factor against the advantages.

Sometimes the problem can be solved by changing the design to a non-flat surface, as this makes chilling unnecessary. Such was the case with plastics automobile radiator caps: they were flat at first and the dog-skin surface resulted. Chilling was too time-consuming for quick production and delivery. The problem was solved by changing the design to a dome shape.

Factors Influencing Design

The question of design is important for obvious reasons, and the manufacturer's design must frequently undergo modifications in the interests of cost, esthetic appearance, moldability or some other factor. One of our customers designed a plastics iron handle with flutings and undercuts and asked us to mold it for him. After careful investigation from the viewpoint of commercial production, we recommended eliminating the fluting, on the basis of appearance and cost. He agreed and the product turned out

to be more smartly stylcd because it was streamlined, as well as cheaper to produce.

This particular procedure is not always advisable. Sometimes, we must follow the reverse procedure and introducc fluting or even beads or ribs to reduce manufacturing cost, the decision depending on the shape of the piece. This illustrates again the individual nature of every problem. What works in one case may not work in another. Formula-thinking or rule-of-thumb methods of operating are impossible if problems like these are to be satisfactorily solved.

Another example, showing how crucial may be the factor of design, was a miner's lamp. Made of metal, it sometimes banged against stone, creating sparks that led to explosion by igniting gases in the mines. To eliminate this hazard, plastics was substituted for the metal in the housing and switches. This was done in spite of the added expense. Improvements in the design, however, reduced cost until today the plastics lamp costs less than the metal lamp, thanks to proper designing.

The veteran molder can draw upon his rich experiences in trying to solve these problems. But even he runs up against new problems that no rule-of-thumb methods can solve. When the plastics telephone receiver was first designed, a rib was planned at the separation line of the molds. It was then decided to eliminate the rib. This could have been done by filing and buffing the surface smooth. Investigation showed, however, that machining a groove was more practical and economical. That is why telephone receivers are grooved today. This solution was the result of the patient working out of a research problem, which is the way every molding problem should be tackled.

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date glass bottle threads. It was only by patient experimentation and trial-and-error attempt that we were able to design a special type of thread that tapers as it recedes into the closure. This is important because if the plastics thread is not designed carefully, the cap will not work smoothly and efficiently.

Cutting production time is a frequent problem for the molder. Alteration of design is one method of licking it, as we have seen. That is one reason why it is so important for a manufacturer to check with his molder before selecting the final design. But other factors may also affect production time—molding technique, for example.

In the molding of hundreds of items today, pre-heating of the plastics is furnishing one answer. This method, not in general use until quite recently, is particularly desirable for heavy-walled products like radio cabinets that take considerable time to heat in the mold. Pre-heating before insertion into the mold has saved time in the manufacture of cabinets, knife handles and many other products. The heating is done electronically as well as in infra-red ovens.

The question of the proper molding method, whether transfer, injection or compression molding, can be answered only on the basis of both experience and trial-and-error. Typical was the experience of the molder who had the problem of molding phenol-urea automatic pencil barrels. With the compression method, he had trouble molding a suitable opening for the long, small-diameter pin that runs through the center of the barrel. The pin had a tendency to bend when thrust through. He solved the problem by transfer molding. The pin is inserted into the mold first and the plastics material squirted evenly around the pin, resulting in an even distribution of pressure. Transfer molding has solved hundreds of such problems, resulting in faster production and better and more efficient end-use.

There is no push-button answer to the problem: what is the best process of molding for a particular product? Just as with the plastics material, so with molding: selection should be based on a careful consideration of all requirements and influencing factors. No one molding process and no one type of plastics material can meet all the requirements to a greater extent than any other.

A Serious Problem

One problem confronting the molder that is at the same time a serious problem to the whole industry is the pressure for cheap and inferior products. In molding, a prime factor is the machining of the mold. This requires time if done properly; otherwise the molds will not fulfill the requirements 100% and the end product will fall that much short of perfection. Many manufacturers who have invaded the plastics market are eager for mass production and quick turnover even at the sacrifice of quality. "Can't you do it faster?" is their favorite question. The answer is: Yes, but the product will not be so good. My company and reputable molders in general have a stake in high quality of output. Inferior products or poor workmanship means a dissatisfied buying public, and this dissatisfaction is bound to boomerang against all the plastics industry, sooner or later. A serious threat to the welfare of the industry, in my opinion, is the attitude of some manufacturers who do not care whether the items they sell are inferior in workmanship on the grounds that, as one of them put it: "We can sell anything today."

There was the manufacturer who asked us to mold plastics ash trays. We recommended certain heat-resistant phenolics for the material, but he insisted on cheaper material even though it was not so heat-resistant. We turned down the order, and without regrets, for sacrifice of quality means, in the last analysis, sacrifice of business.

It is often said that it is important to educate the ultimate consumer regarding the limitations as well as merit-

of plastics. I say that it is also important that the manufacturers or would-be manufacturers of plastics products receive the same education. This is especially true of newcomers in the field. Such education would reduce waste and mistakes to a minimum.

At the same time, we molders have a responsibility both to ourselves and to the industry as well as to the consumers. We should refuse to countenance or encourage the production of inferior products. The industry faces an expanding and prosperous future but only on the basis of integrity and product quality. Molders must educate their customers as to the importance of this objective, discourage rush orders if this involves a sacrifice in quality, and explain patiently that a delay in production and delivery may be an asset instead of a liability because it means better merchandise and a sounder business. END

What the Laminates Offer

(*Continued from page* 65)

can harmonize with the special decorative scheme of a room.

A substantial market, as yet largely unexplored, awaits exploitation by these laminates. There seems to be proper use for them as wall panelling, kitchen work surfaces, bathroom wainscoting and the like. Their greatest prospect may very well prove to be in the unified type of modern kitchen which designers have given much thought to. Thus, it is possible now to produce a splash board and apron for

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Empire State Building New York 1, New York

Architect's drawing of General Electric's new plant, Coshocton, O., occupying 285,000 sq ft, for manufacture of laminated plastics. Initial production is expected soon

the sink in one piece, where it was necessary before to join the several parts with metal strips. Proper installation is an important factor in gaining acceptance for these materials. The bathroom use mentioned above is indicated because the laminates will stand up even under boiling water, but the wainscoting will not be satisfactory unless the exposed edges and the joints between sheets are sealed with waterproof adhesive.

Another use which may be classed as a decorative application is a lighting fixture of translucent laminate. Using a rag paper filler and urea resin, a laminate can be made which has a light transmission up to 70%. The same type of material is also suitable for nameplates. This material made its debut in 1939 and was gaining acceptance when its production ceased in 1941, due to war needs.

Laminates vs. Light Metals

Since the light metals are probably the biggest single competitor of high pressure laminates, something should be said of their comparative cost and performance. Although the laminates of common grades cost from 42 to 82 cents a pound and aluminum about 23 cents, their lower density makes the laminates more economical on a volume basis. (Aluminum has a specific gravity of 2.7, whereas that of the paper and cloth-based laminates is about 1.35.) In strength-weight ratio, the two classes of materials rate about on a par. Other advantages of the laminates are that they dampen vibration, do not conduct heat (so that a seat, for instance, does not get uncomfortably cold at winter temperatures as a metal seat does), and have the possibility of varied surfaces—high gloss, pebbled, matte—besides the decorative effects outlined above in the combination materials developed specifically for the purpose. All in all, the laminates can give the light metals a run for their money.

The choice of the right laminate for a given purpose cannot be made mechanically. Although many laminators have excellent catalogs, the service of the men behind the catalogs is of even greater importance. If there are now a great many standard specifications, it may be said that they originated as special applications, and there is still room for the development of formulations for specific purposes as well as a need for judgment in choosing among the existing standards. For example, the government came to us during the war for an intricate cam on which numerous punching operations had to be performed, and which had to be fungus-resistant. Specifications called for paper-base laminate. We thought a fine canvas base was indicated, but orders were orders and we made what was asked of us—but we also made up some cams from what we considered a more suitable grade. As it turned out, the original specifications proved inadequate, while the ones we made for our own satisfaction, which we coated with fungus-resistant varnish, were serviceable.

Guiding the Customer

In another case, a customer specified a standard grade canvas-filled phenolic laminate for his product, but we were able to point out that we had a special grade available which resists 10% acids and alkalies—a property highly desirable for his purpose. For a fine toothed gear, a cus-

tomer might think a canvas-base laminate was right, but we should call his attention to the advantages of a linen-base type.

If someone were interested in a product of high dimensional stability which also machined very well, he might not find it in the catalog, but we could tell him of the laminates we have developed based on glass cloth bonded with modified polyester resins. This proved highly successful in a precision resistor, where the laminated mounting plate had to be machined to a precise curve and where the slightest change in its dimension would affect the resistance of the wire. Any number of laminates have excellent electrical qualities, but this particular formulation satisfied a specific exacting requirement. So, too, for television and radar equipment operating at ultra high frequencies, we could offer a laminate in which a glass mat is impregnated with a particular modified phenolic resin. The use of silicones as binders is indicated where power factor, dielectric constant and low loss are important, in addition to high heat resistance (the silicones will stand up at a continuous operating temperature of 250° C). Or, if maximum mechanical strength is also required, a melamine resin with asbestos and/or glass cloth filler may be the best thing. All these factors the informed laminator is in a position to evaluate, and the potential customer who makes use of his service gets the most for his money. END

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SITUATIONS WANTED

PRIVATE Individual desires take over management of operating molded plastics company. Has wide experience and exceptional background in Plastics and Chemical Industries. Will contribute financially, if necessary purchase controlling interest. Refer Box 68, % Plastics, 185 N. Wabash Ave., Chicago, Ill.

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INJECTION Molding. Chicago molder will have open time on 8-9 ounce machines beginning March, 1946. Prefer jobs already tooled but can start tooling on new jobs immediately. Here's your chance to get quick deliveries now and also in the future. Box 62, % Plastics, 185 N. Wabash Ave., Chicago, Ill.

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INDEX OF Advertisers

March 1946

Advertiser	Advertising Agency	Page
Aaron Machinery Co.		315
Accurate Molding Corporetion	Rothschild Advertising Agency	267
Accurate Spring Manufacturing Co.	Russell T. Gray, Inc.	105
Ackerman-Gould Company		298
Advance Molding Corp.	Kermin-Thell	47
Agicide Laboratorias, Inc.		296
Airtronics Manufacturing Co.	West-Marquis, Inc.	45
Alexander Hamilton Instituta	Relph H. Jones Company, The	49
Allmetal Screw Products Compeny.	Firestona Advartising Servica, Inc.	293
American Flanga & Manufacturing Co., inc.	Freiwald & Colamen Advertising	14
Americen Hard Rubbar Company.	E. T. Howard Company	231
American Moiding Powder end Chemicel Corp.	Lee-Murrey Advertising Agency	249
American Phenolic Corporation	Evans Associates, Co.	9
American Technicel Society	Doremus & Company	155
Amos Moided Plastics	Sidanar end Ven Ripar, Inc.	52
Andovar Kent Corp.	Leeford Advertising Agency, Inc.	211
Anigraphic Process, Inc.		306
Arrow Plastics Company	Powared Compeny, Tha	27
Art Industries		315
Auburn Button Works Incorporeted	Cherias L. Rumrill & Company	119
Austin Tool & Mfg. Co.		310
Bambarger, A.	Lee-Murray Advertising Agency	239
Bernes & Reinecke	Behel and Waldie and Briggs Advertising	229
Barnett, Inc.		276
Biggs Boiler Works Co., The	C. A. Reece Industrial Publicity	109
Blaisdell Pencil Co.	Richard A. Foley Advertising Agency, inc., The	288
Blum, Julius, & Co. Inc.	J. M. Hickerson Inc.	95
Boice-Crene Company	Wendt Advertising Agency	311
Boonton Moiding Company	A. J. Slomenson, Advartising	38
Bortman Plestics Company	Lawrence F. Dutton	263
Brilhart, Arnold, Ltd.	Henri La Mothe Agancy	Back Cover
Butterfield, T. F., inc.		283
Cardinal Chemical Co.	Feldman, Lefler, inc.	312
Catalin Corporation	Waltar J. Gellagher, Advertising	Second Covar
Celenese Plastics Corporation	Ivay & Ellington Inc.	72, 73
Cello-Nu Products Inc.	Sam Heipern Advertising Agency	241
Cello-Plastic Chemical Co.	H. M. Dittman Advertising	257
Cellupiastic Corporation	M. C. Diedrich	82
Celoid Mfg. Co., Inc.	Powarad Compeny, The	258
Chemaco Corporation	R. T. O'Connell Company	117
Chicago Molded Products Corporation	Aimon Brooks Wiider, inc.	84
Cinch Menufecturing Corporation.	D. T. Campbell, Inc.	41
Cincinnati Grinders Incorporated.	Jeep-Orr Company	159
Clerk, Robert H., Company	West-Merquis, inc.	290
Cohan-Epner Co. incorporated	Diener & Dorskind Inc.	233
Columbie Protektosite Co., Inc.	United Advertising Agancy	75
Columbian Rope Company	Barlow Advertising Agency, Inc.	30
Condor Engineering Co.		246
Consoiidated Molded Products Corporation	Walter J. Gallaghar, Advertising	35
Continentei Can Company, inc.	Batten, Barton, Durstine & Osborn inc.	6
Continentel-Diamond Fibre Company	Harry P. Bridge Company, The	169
Continental Plastics Corporation.	Jim Duffy Company	217
Continental Screw Company	Rossi & Hirshson	269
Cruver Manufacturing Company		183
C-Thru Ruler Company	Post, Johnson & Livingston, inc.	284
Cumberland Engineering Co.	Richerd Thorndika Precision Advertising	235
Curtis Pneumatic Machinery Division	Oakleigh R. French & Associates	225
Davies, Harry, Molding Company.		279
Defience Machine Works, Inc.	Baeson-Faliar-Reichart Inc.	28
Despatch Oven Company	Heroid C. Walker Advertising	266
Detroit Macoid Corporation	Weltar J. Gallagher, Advartising	195
Detroit Matarials Engineering Co.		315
Detroit Moid Engineering Company	Charles M. Gray & Associates	167
Detroit Stamping Co.	Charles Schweim Co.	237
Dow Chemical Company, The	MacManus, John & Adems, Inc.	186, 187
Dry and Company		310
Duall Molding Corp.	Gunn-Mears Advertising Agency	303
Dunning and Boschert Press Co.		294
Dura Plastics, Inc.	Vanguard Advertising	20
Durite Plastics Incorporeted	Lawrence I. Everling	10
Dzuz Fastener Co., Inc.	Platt-Forbes, Inc.	69
Eagle Signal Corporation	Bawden Bros., Inc.	259
Eastern Tool Dasignars		315
Eclipse Fuel Engineering Company.	Van Auken & Ragland	215
Eclipse Mouldad Products Company	Weiss and Geiler Advertising	107
Ekstrom, Carlson & Co.	Cummings, Brand & McPherson, Advertising	310
Electric Auto-Lite Company, Tha.	Ruthrauff & Ryan inc.	37
Emeloid Co., Inc., The	United Advertising Agancy	11
Engineering Specialties Corporation	Maxon Inc.	311
Fabricon Products, inc.		297
Famco Mechina Co.	Western Advertising Agency	311
Federal Telephone and Radio Corporation	Rickard & Compeny	191
Feisenthal, G., & Sons	Liebar Advertising Co.	63
Fenwal incorporated	Cory Snow inc.	67
Franklin Plastics Division	Yount Company, The	245
Gemloid Corporation	Gunn-Maers Advertising Agency	301
Generai Chemicai Compeny	Atherton & Currier, Inc.	17
Generai Electric Co.	Benton & Bowles, Inc.	7
Generei industrias Company, The.	Fuller & Smith & Ross Inc.	23
Garing Products Inc.	M. C. Diedrich	275
Girdler Corporation, Tha	Roche, Williems & Cleery, Inc.	25
Gits Molding Corporation	Merchandising Advartisers	91
Globe Imperial Corporation		26
Goodrich, B. F., Chemical Compeny	Griswold-Eshiemen Co., The	5, 70, 71
Gorski Brothers		270
Greet Americen Color Company		266
Grigoleit Company, The	Mace Advartising Agency, Inc.	32
Hall Line Corporation	Ivan B. Romig Advertising Agency	292
Hartford Taxtila Corp.	Hirshon-Garfield Incorporated	272
Harvay, Guy P., & Son		224
Hawley Products Company	I. A. Feinstein	111
Hopp Press incorporated, The	Geilard Advertising Agency	253
Hummel-Ross Fibre Corporetion	Courtlend D. Ferguson, inc.	79
Huntington Stamping & Plestic Co., Inc.		291
Hydraulic Press Mfg. Co., The	Jey H. Maish Company, The	3
Ideal Commutator Drasser Co.	Van Aukan & Ragland	303
Industrial Equipment Company	Louis F. Hermen Advertising Agency	291
Industrial Moldad Products Co.	Wesley E. Sharer & Associates	156
Industriei Plastics Corporation	Bernes Advertising Agency, Inc.	46
Interlake Chemical Corporation	Stanley Pflaum Associates	77
Johnson City Foundry & Machine Works	L. F. McCarthy & Compeny	243
Jones, C. Welker, Co.	Gray & Rogers, Advertising	281
Karistad, Andrew C.		312
Kearnay & Trecker Products Corporation	Klau-Van Pietersom-Dunlap Associatas Inc.	43
Kingsley Gold Stamping Mechine Co.	Continental Advertising Service	295
Kirk, F. J., Molding Co.	Cory Snow, Inc.	290
Kiise Menufecturing Company		286
Kreiger Color & Chamical Compeny	Warren P. Fehiman Adv. Co.	293
Kuhn & Jecob Molding & Tool Co.	Eidridge-Northrop, Inc.	24
Kurz-Kasch, Inc.	Kirchar, Halton & Collett	51
Kux Mechine Co.	Kuttner & Kuttner	227
La Rose, W. T., & Associetes	Aidridga and Praston Advertising	247
Lance Menufecturing Company		101
Lansky Die Cutting Co.	Aidridge and Praston Advertising	297
Leominster Tool Co., Inc.	Cory Snow, Inc.	139
Lester-Phoanix, Inc.	Gragory Advartising, inc.	92
Maas & Waidstein Company	Hutchins & Graves, Inc.	40
Mack Molding Company, inc.	George Homer Martin	18
Mac Ree's Blue Book	Western Advertising Agency	282
Magnetic Plastics Company, The	Gragory Advertising Incorporatad	316
Maico Company Inc., The		305
Merbiette Corporation, The	Pariowin & Pariowin	161
Martindell Molding Co.	Eidridga-Northrop, Inc.	16
Master Plastic Molding Corp.		121
Meeri Corporation, The		300
Mayer & Brown Corp.	Freiweid & Colaman Advertising	302
Meyercord Co., Tha	C. C. Fogarty Company	135
Michigen Moldad Plastics, Inc.	Wallace-Lindamen, Inc.	89
Midland Die and Engraving Company	Behel and Waldie and Briggs Advertising	199
Miiis, Eimer E., Corporation	Jacobs Company, Inc., Tha	19
Minneapoiis Plastic Moiders Incorporatad	Addison Lewis & Associates	42
Misenar Mfg. Co., Inc.		305
Moided Products Corporetion	Cruttendan & Egar Advertising	59
Mosinee Paper Mills Company	Klau-Ven Piatersom-Duniep Associetas Inc.	81
Munising Papar Company, The	Robart A. Geilaghar Sarvica	246
McAlear Manufecturing Co.		133
National Lock Company	L. W. Ramsey Advertising Agency, Tha	287
National Organ Supply Co.	P. W. Price, Advertising	220
Netionel Plastic Products Company, The	Joseph A. Wiinar Company, The	305
Netional Vuicanized Fibre Co.	John Gilbart Craig Advertising	99
Niacet Chemicels Division		286
Nicholl Hard Chroma Sarvice		298
Northern Industriai Chemicai Co.	Callawey Associates, Tha	299
Owens-Corning Fiberglas Corporation	Fuller & Smith & Ross Inc.	22

Advertiser	Advertising Agency	Page
Owens-Illinois Glass Company	J. Walter Thompson Company	61
Pennsylvania Coal Products Company	Lee-Murray Co., Advertising	8
Plaskon Division, Libbey-Owens-Ford Class Company	Meldrum & Fewsmith Advertising	202, 203
Plastic Engineering, Inc.	Super-Vision	125
Plastic Industries Inc.		251
Plastic Mold Engineering Co.		310
Plastics Associates Incorporated	Deane-Klein-Davidson Company	215
Plastics Exhibitors, Inc.		306
Plastics Industries Technical Institute	Beaumont and Hohman Incorporated	284
Plastics Service Co.		300
Plastics Service Engineering		312
Plax Corporation	Charles Brunelle	97
Pomona Machine Works	Moore & Schacht	307
Precision Design Service		302
Preco Incorporated	Shaw Company, The	277
Presque Isle Plastics, Inc.		252
Printloid, Inc.	Reiss Advertising	36
Protective Coatings, Inc.	Associated Business Counselors	310
Pyro Plastics Corporation		137
Quarnstrom Tool Co.		276
Radio Receptor Company, Inc.	John A. Finneran	29
Raymond Laboratories, Inc.	Firestone Advertising Agency	307
Rayon Processing Co. of R. I. Inc.	Richard Thorndike Precision Advertising	44
Reed-Prentice Corp.	Howard-Wesson Co.	157
Reichold Chemicals, Inc.	MacManus, John & Adams, Inc.	165
Resinous Research Associates	Equity Advertising Agency	292
Rezolin Co., The		309
Rohm & Haas Company	Newell-Emmett Company	39
Rothco Products	Rothschild Advertising Agency	261
Royle, John, & Sons		113
Schwab & Frank Inc.		285
Schoder & Lombard Stamp & Die Co., Inc.		288
Schwartz Chemical Company	Gunn-Mears Advertising Agency	282
Shaw Insulator Company	Charles Brunelle	96
Siegel, M. S., Associates	Milton M. Mendelsohn Agency	310
Sillcocks-Miller Co., The	Fred H. Ebersold Inc.	265
Slater, N. G., Corporation	Kermin-Thall	103
Society of the Plastics Industry	James R. Flanagan Advertising Agency	15
Sossner	Ehrlich & Neuwirth	242
Speed-O-Laq Products Company		308
Standard Products Company, The	Brooke, Smith, French & Dorrance, Inc.	48
Stekert, Martin M.	Walter W. Wiley Advertising	308
Sterling Plastics Company	Walter J. Gallagher, Advertising	31
Stevenson, H. N., Jr.		310
Stokes, F. J., Machine Company	McLain Organization, Incorporated	12, 13
Stricker Brunhuber Co.	Aldridge and Preston Advertising	295
Sutphen, Frank J.		307
Synvar Corporation		289
Taylor Fibre Company	Gray & Rogers	34
Tennessee Eastman Corporation	Kenyon & Eckhardt Inc.	57
Texon Industrial Corp.		312
United Plastics Co.		309
Universal Hydraulic Machinery Company	Gunn-Mears Advertising Agency	312
Universal Plastics Corp.	Cayton, Inc.	123
Universal Plating and Novelty Co.		313
Valley Manufacturing Co.	Philips Webb Upham & Company	271
Velepec, Fred M., Co.	Schacter, Fein & Lent	301
Vickers, Inc.	Witte & Burden, Advertising	126, 127
Victory Manufacturing Company	Earle Ludgin & Company	255
W. & A. Company		309
Walker-Goulard-Plehn Co.	House of J. Hayden Twiss, The	304
Walker-Turner Company, Inc.	Thoma & Gill	223
Waterbury Companies, Inc.	Manternach, Inc.	304
Watertown Manufacturing Company	R. T. O'Connell Company	33
Western Shade Cloth Company, The	Hardy Advertising	21
Westinghouse Electric Corporation	Fuller & Smith & Ross Inc.	131, 176, 177
Wiley, John, & Sons, Inc.	Ray-Hirsch & Waterson	299
Williams Apparatus Co., Inc.		232
Wilson Carbon Company Incorporated		313
Worcester Moulded Plastics Co.	C. Jerry Spaulding, Inc.	Third Cover
Wrigley, Wm., Jr., Company	Ruthrauff & Ryan, Inc.	219
Yardley Plastics Co.	Byer & Bowman Advertising Agency	87
Ziv Steel & Wire Co.	Vernon S. Weiler Advertising	115

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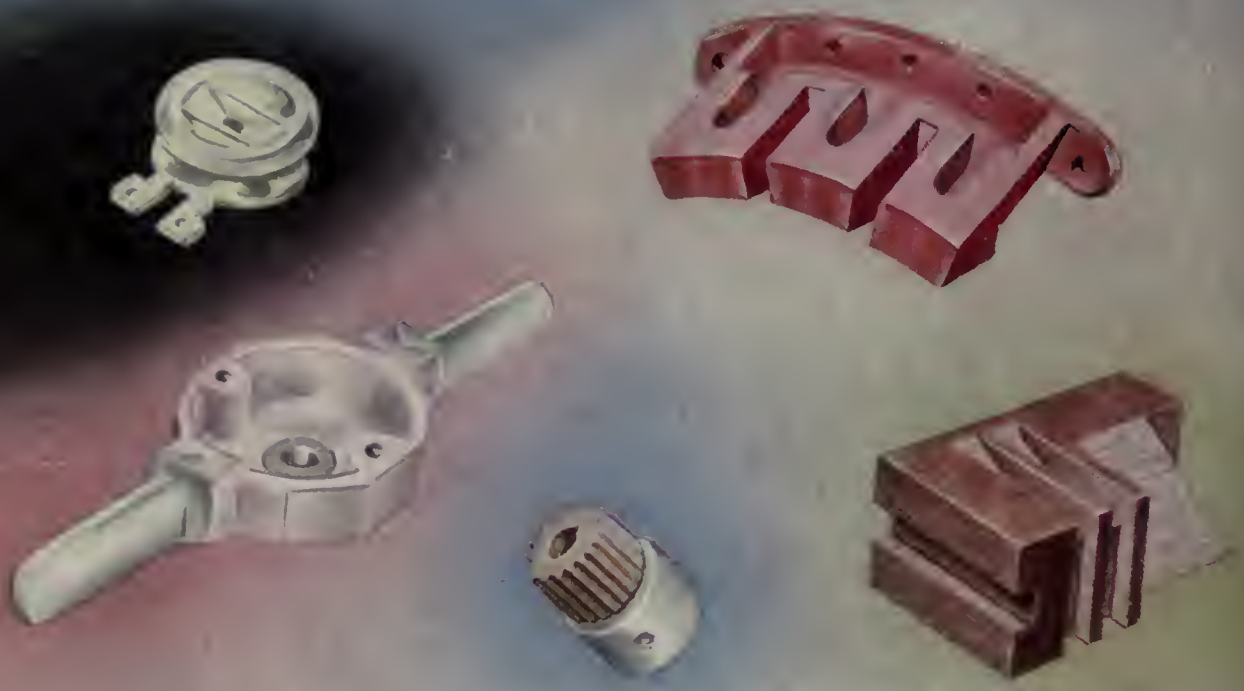

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plastics

APRIL
1946

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Catalin's brilliant rich colors and physical properties commend the gem of plastics for use in toys—especially crib toys. Catalin is strong, and as pictured herewith and produced by Tykie Toy Co., readily fabricable into the various sizes and shapes required for assembly or stringing. Catalin's colors won't chip or peel—for Catalin is all color—clear through. Its high polish never dulls, the surface is smooth; easily wiped clean. If by chance, and the chances are good, that Catalin comes in contact with baby's mouth, mother need hold no fears because Catalin is odorless, tasteless, harmless.
Should you happen to be entertaining new ideas for toys—or anything plastic—we, at Catalin, would like to assist your thinking and planning. Inquiries invited!
CATALIN CORPORATION • ONE PARK AVE., NEW YORK 16
Catalin
CAST RESINS • MOLDING COMPOUNDS • LIQUID RESINS

The 100 rubber parts illustrated at right represent a typical turbojector molding. Each part is 27/32" dia. with 31/32" dia. flange. Overall length 1-3/32". Hole through center 15/32" dia. Total weight of shot 2-1/2 lbs. Cure time—1 1/2 minutes. Injection time—1 1/4 minutes. Total cycle time—4-1/2 minutes. Molder—Acushnet Process Company.

THE H-P-M TURBOJECTOR

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This new revolutionary injection machine is designed for production molding of both natural and synthetic rubber. Injection capacities as high as eight pounds per cycle have been secured.

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The H-P-M Turbojector has greatly reduced production costs. For example, preforms are not required. Mold is filled automatically. Curing time has been greatly reduced, and in some cases as much as 93%. Due to elimination of flash, finishing operations have also been reduced to an absolute minimum.

The H-P-M straight-line hydraulic mold clamp insures positive sealing of mold halves. Entire machine is fully automatic, requiring little manual effort. H-P-M pumps, valves and controls are employed for all hydraulic actions. Investigate this new revolutionary injection molding machine. Write today for H-P-M Bulletin 4601.

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HPM

REVOLUTIONIZING PRODUCTION WITH HYDRAULICS SINCE 1901

TURBOJECTOR MOLDING MACHINE

APRIL, 1946

plastics

VOLUME 4, NUMBER 4

in this issue

Plastics in Dentistry ..... *Philip Pollack* 21

An Eye for An Eye ..... *Major V. H. Dietz* 26

Notes on Commutator Design ..... *M. A. Prince* 30

The Schick Shaver—A Case History ..... *William Schack* 34

The Ark That 'Tenite' Built ..... *V. E. Gibbens* 42

Using Vinyl Films for Decorative Edgings ..... *Betty Frank* 47

An Interpretative Survey of German Plastics Fabrication ..... *W. C. Goggin* 50

SPI Conference and the National Plastics Exposition 60

Cementing Phenolic Laminates ..... *John Delmonte* 62

SPE Convention and Exhibit 72

departments

Plastics in Perspective 18

On the Drafting Board 49

Plastics at Work 68

I Beg to Differ! 73

What's New in Plastics 75

Literature Review 77

Problems in Plastics 79

Industry Highlights 80

People 84

Engineering News Letter 86

Association Activities 88

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COVER

Gluing extruded deck seal on hull (rear), scraping flash off cabin (center), and gluing cabin to deck in assembling Noah's Ark at Amos Molded Plastics, Edinburg, Indiana. Photograph by Arthur E. Haug.

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low it's fly swatters made from Geon ...

... What will they think of next?

N enterprising mid-Westerner had heard about GEON raw materials and the many things at could be made from them. So, he asked himlf, why not fly swatters? Products made from EON, he knew, resist oils and chemicals, sunlight, ing, repeated impact, abrasion, and many other rmally destructive factors. They keep their shape definitely. They can be brilliantly or delicately lored. They can be waterproof and, so, easily ashed. And GEON can be compression molded injection molded, extruded, calendered or cast to sheet and film.

Samples were made and tested. The initial order as for 300,000 swatters, called Odor-Swat, the King Swats, made from GEON. These swatters are oing to make a good many impressions—on unspecting flies—this summer and for years to come.

It may seem a far cry from fly swatters to delicate film for the packaging field—or from dainty make-up capes to linings for acid tanks—from car upholstery material to insulation for wire and cable. But that's the way GEON is; versatile, easy to process, with applications—established and potential—*in literally every field.*

For more information about GEON raw materials and what can be done with them please write Department U-4, B. F. Goodrich Chemical Company, Rose Building, Cleveland 15, Ohio. In Canada: Kitchener, Ontario.

Geon
Polyvinyl Materials

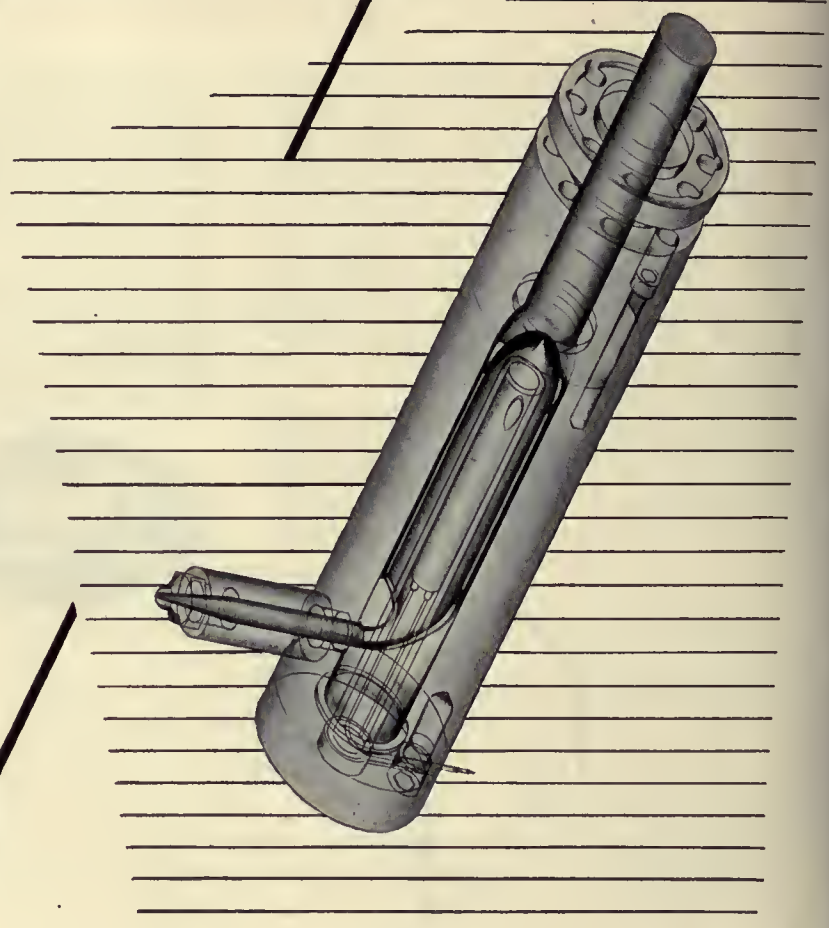
Here are a few applications for GEON uggested by the unusual properties of the fly swatter

extile cootings for roinweor, ownings, industrial oprons.
alendered, embossed sheet for upholstery ond luggage.
alendered or molded sheet for flooring, shoe soles, nower mots.
aper coatings or film for packaging, woll covering.
xtruded wire ond coble insulation.

Photo courtesy The Odor-Swat Co., Brecksville, Ohio

B. F. Goodrich Chemical Company A DIVISION OF THE B. F. GOODRICH COMPANY

INJECTION MOLDING



TAKES A STEP FORWARD

In the injection molding process, it is primarily the heating and injection system of the machine which makes the difference between efficient and inefficient operation. Heat input, horsepower consumed, cycling speed, molding quality, reject percentage—all depend largely upon the performance of the injection cylinder, "the heart of the machine". Leading plastic molders* have tested the new Lester internally heated solid-plunger injection cylinder under the most severe working conditions, and have reported production increases up to 40 percent, reject percentages cut as much as 75 percent, and temperature reductions as great as 135 degrees, along with distinctly better plasticization. Don't these facts stimulate *your* curiosity? Write us for complete data.

*Names on request.

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INJECTION MOLDING MACHINES

Distributed by **LESTER-PHOENIX, INC.**

2711 CHURCH AVE., CLEVELAND 13, OHIO

Emeloid BRIGHTENS THE KITCHEN..

WITH COLORFUL NEW PLASTICS!

All-plastic Waste Basket Pat. Pending

All-plastic Dish Drain Pat. Pending

Emeloid—long a pioneer in the production of colorful plastic kitchen accessories—again steps to the fore with a smart, modern dish drain and waste basket. The result of a new molding technique developed by Emeloid, these new kitchen accessories are attractive, washable, durable and economical. Here's additional proof that Emeloid molds for practicality—for sales—for what the consumer wants.

A. Dish Drain B. Waste Basket C. Knives, Forks, Spoons D. Napkin Holder E. Sink Drain F. Curtain Tie-Backs

25 YEARS OF
"PROGRESS IN PLASTICS"
Special articles molded for the trade

The Emeloid Co., Inc.
ARLINGTON, NEW JERSEY

There's no "coin-flipping" substitute for experience in plastics, regarding . . .

CHOICE OF MATERIALS

IT MUST BE RIGHT!

A good molder is more than just an "order taker"—he should have the neeessary experienee to select the proper plastie material for the job. Using the correct compound—and designing the best mold to proeess it—require long and varied experience. It is this ability that is identified with sound plastie produetion . . . that will insure the best possible measure of success in building a satisfaetory, saleable produet.

MACK MOLDING COMPANY—serving industry for over a quarter century—has had the neeessary experience in the design and production of molded plastics.

This experienee is available to you, and, in the planning phase, we shall frankly tell you if plastics are praetical or impraetical for your purpose. Our eight-page brochure will enlighten you eoncerning both the intricacies of plastics and the broad scope of MACK MOLDING facilities. Write for it today.

For Molded Excellence

★

Mack

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Dividend— 650 GALLONS

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TRI-SURE FULL DRAINAGE
in average
10,000-drum shipment

The T Square Test shows the flush fitting of the Tri-Sure Flange which guarantees full drainage.

THE result of recent tests of closures by an independent oil company showed that Tri-Sure Closure fitted drums drained an average of 8.34 ounces more than the others. Figured on the scale of a 10,000 — 55-gallon drum shipment, the consumer will recover 650 gallons or over which otherwise would have remained in the drums.

The flush fitting of Tri-Sure flanges assures complete drainage and you receive all you pay for.

Mark your orders, "Drums to be fitted with Tri-Sure Closures."

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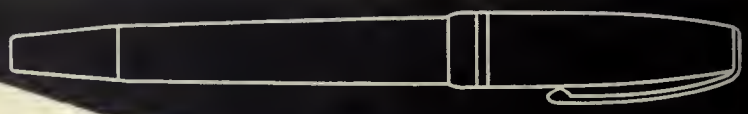
TRI-SURE PRODUCTS LIMITED, ST. CATHARINES, ONTARIO, CANADA



molded *Automatically!*

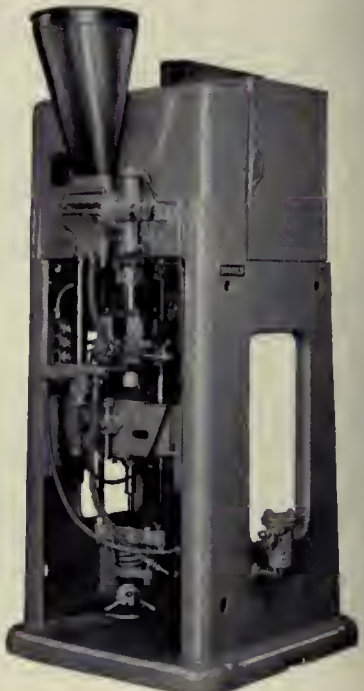
With savings of thousands of dollars per year.....

Caps for a nationally-known brand of pens and pencils used to be molded by conventional methods. The large, multiple-cavity molds needed to hold labor cost per piece within reason produced a year's supply in a few weeks. Result — heavy inventories and large mold investment lying idle.

Now these parts are molded automatically, as needed, on Stokes Presses. The savings in labor costs and inventory total several thousands of dollars per year. *Plus* an "extra" bonus — accuracy is so improved that rejects and time lost in assembly are negligible.

Investigate the demonstrated economies and competitive advantages of Completely Automatic Molding now.

F. J. STOKES MACHINE CO.
6040 Tabor Road Philadelphia 20, Pa.



(Stokes 200-D Completely Automatic Molding Press. 15 tons capacity.)

50th year of Service to Industry

F.J.Stokes MOLDING EQUIPMENT FJS Est. 1895

Thermex does a Job for General Industries

Vice President O. W. Marsh and sales manager Steve Hiltebrant of The General Industries Company, Elyria, Ohio, look with satisfaction at one of the Philco radio cabinets perfectly molded by their firm with the aid of THERMEX high frequency heating equipment. THERMEX was originally selected after tests involving various makes of high frequency heating equipment. The selection proved so advantageous that now General Industries uses THERMEX Red Heads on a plant-wide basis... the largest known installation. The Girdler Corporation, Thermex Division, PM-4, Louisville 1, Kentucky. Branch offices: 150 Broadway, New York 7; 228 N. LaSalle St., Chicago 1; 1836 Euclid Ave., Cleveland 15.

THERMEX *and* RED HEAD *T. M. Reg. U. S. Pat. Off.*

● Preforms for radio cabinet are placed in THERMEX drawer. Then drawer is closed, high frequency energy functions within the material, heats preforms uniformly throughout. This permits larger preforms, reduces failures from "pills" not knitting, allows less critical molding procedures.

● Preforms are removed from the THERMEX drawer perfectly plasticized—no hard cores—ready for the press. Molds are closed faster and a more certain cure is obtained in shorter time. Greater quantities of the radio cabinet are produced for fewer tool dollars.

● When the mold is opened the net result is a job that will pass inspection with the quality that makes critical customers like Philco come back for more. THERMEX at General Industries has increased the productivity of mold cavities on various jobs from 20% to 75%.

● Typical THERMEX high frequency heating production line at General Industries. This firm is operating batteries of THERMEX Red Heads of various capacities, possibly the largest installation of its kind in the plastics industry. It was possible to fit all of these compact, self-contained units into the plant without rearranging presses.

● In addition to the Philco radio cabinet, General Industries uses THERMEX high frequency heating to streamline the production of many other plastic products. From simple to complex, from small to large, these items are eloquent proof of THERMEX Red Heads' wide range of usefulness in the plastics industry.

Thermex RED HEADS

give you the most complete line of high frequency heating units designed especially for the plastics industry. There is an appropriate capacity for every job. Every model is portable, simple to install, simple to operate. See one in action, booth No. 92 at the—

SPI MEETING

THE FIRST INDUSTRIAL HIGH FREQUENCY DIELECTRIC HEATING EQUIPMENT—A GIRDLER PRODUCT

Plastics is a Problem for the beginner!

We cut our plastics teeth
during postwar number one,
and long learned the A,B,C's
of injection and compression molding.

For almost a quarter century
We've been designing products and tools,
Molds, dies, jigs, and fixtures
for thousands of new applications.

We've the facilities . . . and experience
to know when designs are faulty
whenever passed along to us . . .
Which all means: quality production.

So to avoid many "blind alleys"
during postwar number two,
When you're scouting for a molder
Take a short cut . . . give us the job to do.

BMCD

ARMY E NAVY

SPI SOCIETY OF THE PLASTICS INDUSTRY

BOONTON MOLDING COMPANY

MOLDERS, BY MOST ALL METHODS, OF MOST ALL PLASTICS

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STYRON

DOW POLYSTYRENE

THE NAME YOU CAN DEPEND ON IN PLASTICS

rated no. 1 in refrigerators

Styron is a name that is growing in the refrigerator and other forward-looking industries—with reason!

Modern refrigerators gain a new measure of attractiveness—along with rugged serviceability—with parts made from this Dow plastic. Styron's easy moldability, low water absorption and dimensional stability at low temperatures are qualities that give it unique value for profitable production of fine refrigerators. That's why Styron is rated No. 1 in making ice compartment doors, crisper fronts and numerous other parts for today's leading refrigerators.

But its broadly useful properties and low price dictate the choice of Styron for a wide variety of products. Styron conveys clear brilliance to costume jewelry and cosmetic containers. Its acid resistance recommends it for batteries. Its high dielectric strength and low specific gravity suggest an ever-growing list of applications.

In refrigerators, in numerous products—Styron is the name you can *depend* on in plastics!

let's work it out together

Success in plastics is measured only in end products. It calls for the combined efforts of manufacturers, designers, fabricators and raw material producers. Dow is ready to do its part. Call on Dow and get the most out of plastics.

RESENT AND PDTENTIAL USES: Lighting fixtures; insulators, battery cases; hydrometers; innels; closures; food handling equipment; pharmaceutical, cosmetic and jewelry ontainers; costume jewelry; novelties; refrigerator parts; pens; pencils; liquor ispensers; escutcheons; chemical apparatus; dishes; lenses; decorative objects, trim.

RDPERTIES AND ADVANTAGES: Clear, translucent or opaque; broad color range; excellent igh frequency electrical insulator; can "pipe" light through curved rod, and around orners; resistant to acids and many alkalies; low water absorption; light weight; table at low temperatures; limited solvent resistance; available only in rigid forms.

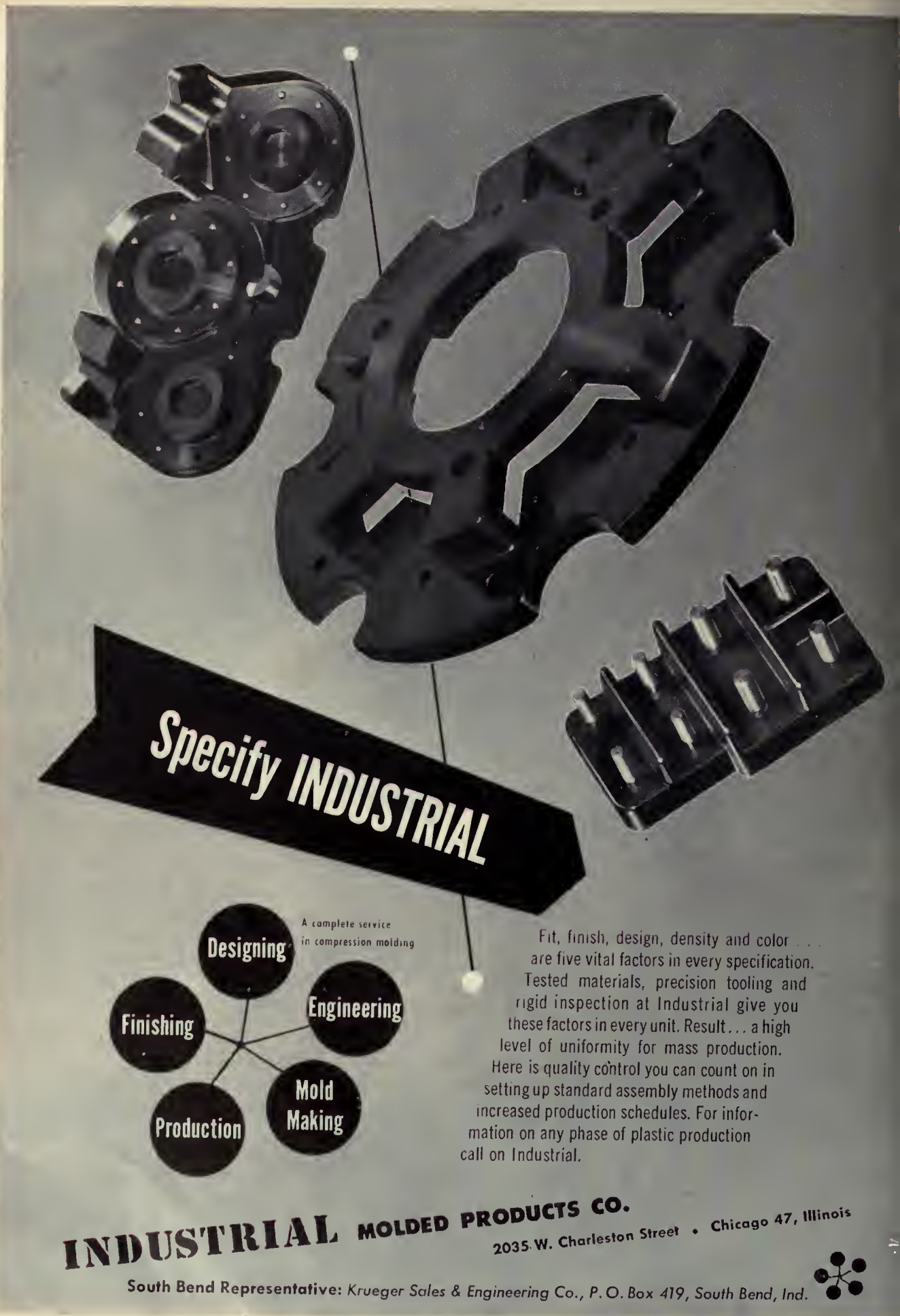
DOW

PLASTICS

ETHOCEL • ETHOCEL SHEETING

STYRON • SARAN • SARAN FILM

HE DOW CHEMICAL COMPANY, MIDLAND, MICHIGAN • New York, Boston, Philadelphia, Washington, Cleveland, Detroit, Chicago, St. Louis, Houston, San Francisco, Los Angeles, Seattle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A complete service in compression molding
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Finishing
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Fit, finish, design, density and color . . . are five vital factors in every specification. Tested materials, precision tooling and rigid inspection at Industrial give you these factors in every unit. Result . . . a high level of uniformity for mass production. Here is quality control you can count on in setting up standard assembly methods and increased production schedules. For information on any phase of plastic production call on Industrial.
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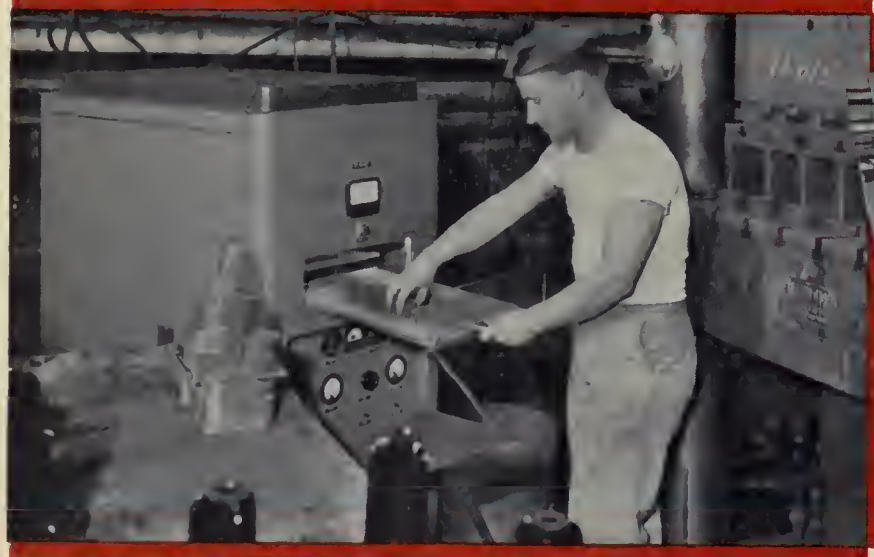
INDUSTRIAL RESINS

ADHESIVES & CEMENTS • MOLDING COMPOUNDS

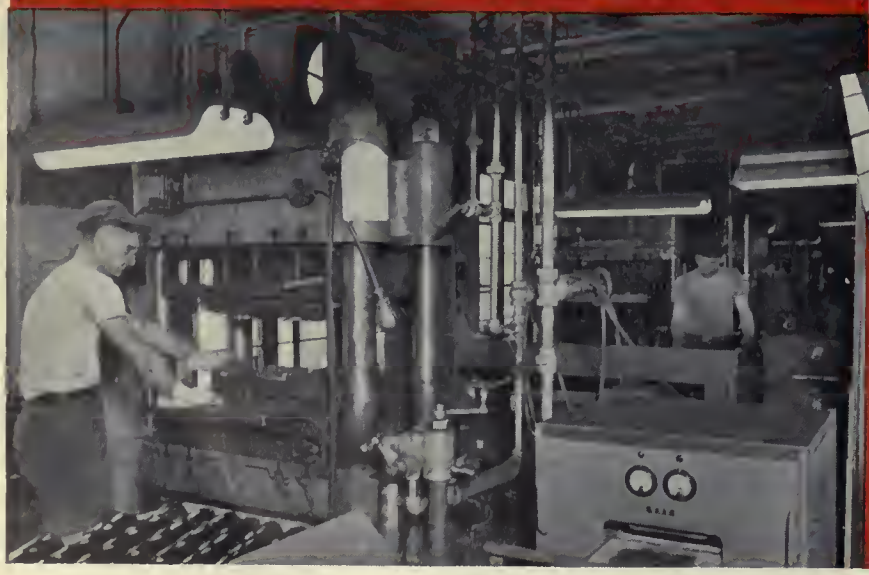
DURITE PLASTICS INCORPORATED • 5000 Summerdale Ave. • Philadelphia 24, Pa.

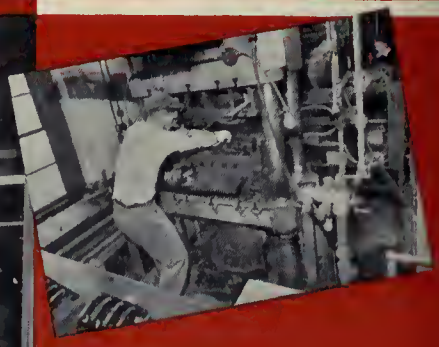
We've added HEATRONICS

One aisle in the plastics molding division at General Industries Company, showing complete Heatronic equipment. Our engineers have the "know-how" to make full use of it.



"Before and after" views of the 2-cavity molding of a plastics agitator for a washing machine. High frequency heating permits better productian af such large and complex parts.





These electric iron handles are made in 4-cavity malds. The illustrations shaw placing the pre-farm and unloading the finely-finished part.

to our PLASTICS MOLDING team!

Our customers profit from our extensive installation of Thermex high frequency preheating equipment. This most modern improvement in plastics molding processes enables us to produce more and better pieces per mold cavity. In many instances, the number of cavities needed can be reduced, thus effecting savings in both cost and time.

More important, however, are the resulting improvements in product quality with high frequency preheating. Among the advantages which you will gain are:

Better cure
Uniform density
Less internal stress
Higher gloss
All around improvement of physical properties

This General Industries installation is one of the largest in the plastics molding industry, and additional units are now on order.

Added to our batteries of 150 presses (from 40 tons to 1000 tons), and to the alertness and skill of our engineers, moldmakers and machine operators, high frequency heating brings new power to our plastics molding team and thus enables us to serve you better than ever before.

Our engineers will be glad to work with you on present or future products. Consult us, without obligation, of course.

MOLDED PLASTICS DIVISION

THE GENERAL INDUSTRIES CO.

ELYRIA • • • • OHIO

PLASTICS in PERSPECTIVE.....

HE'S BACK is a little 24-page booklet published by the War Department. Its modest cover shows a soldier's duffel bag standing in the doorway anyone knows represents home. The booklet "is intended primarily for the information of families whose soldiers are returning from the Army with battle wounds or other disabilities."

It was with mixed feelings that we leafed through the simple presentation. The homely advice to the relatives of disabled veterans was not without pathos. But the longer we looked, the more we began to boil inside. Not at the simple little set of *do's* and *don'ts,* but at the thought how insignificant and helpless and futile all this seemed in the light of the veteran's greater needs than could hardly be solved by a few pages of the best-meant advice to their families.

A number of ways came to mind in which we have shirked our responsibilities to our returning men after they served beyond a calculable value in dollars and cents. And—to cite only one—the mess we made of the housing situation seemed enough to indict us severely. In plain words, the situation is odorous.

Pressure groups representing selfish interests and other groups of obstructionists have made a travesty of the efforts to launch a housing program. Unless a better solution to the problem can be found than now seems possible, the travesty will become a tragedy, and the principal sufferer, at least in the next six months or a year, will be the returning GI.

Now that the General Motors strike is settled and chances are brighter than they have been in a long time for a full-fledged effort to get the wheels of peace-time production rolling at record speed, let us promote a whole-hearted, unselfish attempt to do something about a situation which is beginning to assume the proportions of a national disgrace.

One of the best ways to show our gratitude to the man who gave up some of the best years of his life to fight for us is to build him a house to live in. And we know that our industry can contribute substantially to the beauty, utility, and comfort of that house.

* * *

THE Industry Division, Bureau of the Census, Department of Commerce, has recently instituted a continuing series of monthly releases, *Facts for Industry,* Series M19H, "covering the shipments and consumption of plastics and synthetic resins." Shipments refer to plastics and resins manufactured by the reporting companies or company divisions and shipped to outside users. Consumption refers to the quantities of plastics and resins which are manufactured and used by the reporting companies or company divisions.

The report is still comparatively new, and the lag in the collection of information is expected to be reduced considerably once the manufacturers perfect their reporting systems. As an example of the delay at present the Industry Division did not receive all reports for November until January 17. The objective is to remedy this condition so that it will be possible to obtain all reports and publish the results within 30 days after the close of the reporting month.

The seven general classifications of resins and plastics in the monthly report include cellulose acetate and mixed ester plastics, nitrocellulose plastics, phenolic and other tar acid resins, urea and melamine resins, polystyrene, vinyl resins, and miscellaneous plastics and resins. Once the gathering and presentation of the statistical data are completely stabilized, it will be of interest to follow the statistics for their indication of seasonal fluctuations and long-range trends in total shipments and consumption for all plastics and resins and also for individual classifications. In time, as the data accumulates and thus becomes more valuable for comparative purposes, it will undoubtedly prove valuable in forecasting future marketing possibilities.

That the Department of Commerce has seen fit to inaugurate this new service is further testimony that the plastics industry is taking an important place in the American business scene.

* * *

IT ISN'T often that we blow our own horn, even though many people have been complimenting us on the fine job we are doing for the plastics industry. So we hope we'll be pardoned for getting almost eloquent over the fact that we have just been admitted to the coveted and relatively cloistered halls of the Audit Bureau of Circulations. We're mighty proud to have been accepted to membership, and to join the illustrious group that comprises ABC, and we're even prouder because we made the grade in the short span of eighteen months. We believe we set some sort of a record for plastics publications by doing that.

When **plastics** magazine was launched just a shade less than two years ago, one of its announced purposes was to act as liaison between the material manufacturer and the end user. There was a need for this service because the manufacturers' message to the man who was using his product had to be delivered in the semi-technical, clear and concise terms the latter could understand and appreciate.

That we have done this part of our job well is evident in the fact that **plastics** magazine leads the other plastics ABC publications in 12 of the 17 approved end-user categories, and is so close in three of the others that there is relatively no difference in the totals.

While our admittance to the Audit Bureau of Circulations was an important event in our lives, admission by the *whole* plastics industry that we are filling an important and vital place in its industrial life was our more important achievement. END

niform Denseness saves Tenseness

. . . in Plastics, too!

UR PLASTIC PART can be molded
h a uniform density unheard of
y a short time ago — before
ıtronic molding. It took radio-
quency pre-heating to give the
her plasticity, lower molding
ssures and improved cure that
der this happy result.

Uniform density of the piece, of
ırse, improves every application
ven makes new ones feasible. It
mits figuring on reduced stress
ıcentrations, better dimensional
bility and increased strength
tors—impact, compression, ten-
, flexural and dielectric.

There are plenty of other plus factors derived from Heatronic molding—enough to more than warrant your talking them over with us. Why us? Because Kurz-Kasch offers a molding plant that's grown since birth of the industry—a large and still growing Heatronic installation —*and the experience to go with the equipment.* After all, didn't we pioneer Heatronics for plastics?

You bet we did! Ask a Kurz-Kasch engineer about our complete custom molding service—by phone or by letter.

Kurz-Kasch

r Over 29 Years Planners and Molders in Plastics

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RuMor Plastic Bottle Carrier—
Molded for Rush Morgan Company,
Lafayette, Indiana

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PLASTIC PARTS
FOR ELECTRICAL APPLIANCES
OFFICE MACHINES OR INDUSTRIAL EQUIPMENT
Special Handles and Control Knobs for
TOOLS RADIOS AUTOS PLANES
CASES FOR CLOCKS CAMERAS JEWELRY
BATHROOM FIXTURES MEDICAL ACCESSORIES
Or Anything Else that's a
Practical Plastic Application
You Get the Job Done Right by

This plastic carrier is a handy device that necks six bottles at once. Turn it about in your hands and you'll be amazed at this ingenious engineering and plastic molding job.

Handle and bottle-rack are molded in one piece and the two retainer-pieces are fitted with coil springs to lock or release the bottles. Moisture-proof, durable, economical . . . this carrier has merchandising effectiveness you always find in the practical beauty of plastic products.

Amos engineers have every facility to help you develop new products, or redesign for the advantages of plastics. From engineering to finishing, Amos jobs are done right. Send us your drawings or write us what you have in mind to be molded in plastics.

AMOS MOLDED PLASTICS, EDINBURGH, INDIANA
Division of Amos-Thompson Corporation

Amos
MOLDED PLASTICS...

CUSTOM Molders of
Plastic Parts and Products
Injection Molding Specialists

"Plexiglas" denture is so tough that it can "bite" a pencil in two

Plastics in Dentistry

By Philip Pollack

Efforts of dental profession to use plastics dates to 1870, but with indifferent results until advent of the phenolics and, still later, the acrylics

THE dental profession has long recognized the importance of plastics, especially the synthetic resins, in making dental prostheses. Not only has it been receptive to the possibilities of new plastics materials when they appeared on the market, but it has also, owing to the exacting requirements of its work, encouraged research for better materials and processes. Resin producers have given full cooperation, with mutual advantage to both parties.

The interest of dentistry in plastics dates back to 1870, when cellulose nitrate was tried as a replacement for rubber. It had a tendency to warp, soften and discolor and had to be abandoned. During the first World War, however, it was again introduced in an improved form in Germany, probably owing to the shortage of rubber. Its use spread to other countries and several materials of this type have been tried along with rubber over a long period of time, though with negative results.

The next commercial plastics investigated by dentists was phenol formaldehyde. By 1927 it was perfected to the point where its advantages over rubber outweighed its disadvantages. The dental profession was quick to adopt this new plastics, and by 1932 it was widely used.

The phenolic resins were superior to rubber in appear-

The denture, which is made of wax with teeth correctly set, is invested in plaster in a two-part metal flask

As the next step, before final investing takes place, tin foil is carefully burnished over the wax denture

Next, the wax is removed with boiling water, leaving a foil-lined mold of plaster for receiving the resin

Acrylic powder (polymer) and liquid monomer, measured for mold charge, are mixed to produce a rubbery dough

ance, color, dimensional stability, and accuracy, but lacked the required toughness. For this reason, dental laboratories investigated, as soon as they were developed, such new plastics as cellulose acetate, glyptals, polystyrene, polyvinyl esters, etc. None of them proved satisfactory for dentures, however, and none was superior to the phenolics.

The next great step was the development of the acrylic resins for denture material. Research in the problem began in this country in 1936 at a time when there were no commercial acrylic resins available and no experience in molding this plastics to serve as a guide.

The application of methyl methacrylate to dentures had been previously reported from England and Germany, but molding efficiency was limited by the use of heat-softened polymers. Pure methyl methacrylate polymer in the form of a fine powder does not soften sufficiently, even under high temperature and pressure. It can be made to do so by the addition of a plasticizer, but this impairs its purity, makes it too soft, lowers its resistance to chemicals, and results in post-mold changes in dimensions. This was the problem facing American dental research: how can the moldability of the plastics be increased without impairing its purity?

The problem was solved by combining a pure liquid monomer of the acrylate with a pure powder polymer. This creates a soft dough which is readily moldable and which, on the application of heat, converts over to a solid, homogeneous polymer of methyl methacrylate. The liquid monomer acts as a softening agent to make the plastics moldable. But when heat is applied to the polymer-monomer dough, the monomer becomes a *hardener* instead. Unlike a plasticizer which remains with the resin and leaves the end-product soft, the monomer remains with the resin but reverses its role with the application of heat to create hard-

As the next step in the operation, the plastics dough is pressed firmly into the plaster mold with a spatula

After a bench pressing in the closed flask, flask is re-opened, excess flash removed, and more dough added

, as it identifies itself chemically with the polymer to ch it has been added.

he molded plastics resulting from this method is harder tougher than that made from pure, dry powder, despite fact that the polymer-monomer molding is accomplished rclativcly little heat and pressure while dry powder ding requires very high temperatures and pressure. The on for this is, in part, that the grains of the plastics fused by the slightly solvent action of the monomer, reas in dry powder molding, the grains are merely ked together.

wo facts emerged from the research: (1) that, of all lable acrylic or methacrylic derivatives, methyl metha- ate is by far the most desirable as the basic material for al restoration; and (2) that, as far as dental require- ts are concerned, the purer the resin used, the better. first point is based on the superior strength, hardness stability of methyl mcthacrylate compared to the other bers of the acrylic family investigated. The second t dcrives from the fact that these qualities reach a inum when the resin is unadulterated.

w Process Becomes Popular

he new process of combining monomer and polymer me very popular and has been adopted by dental labora- es all over the country in the last five years. The acrylic fair to displace all earlier types of plastics in this field. cording to one estimate, it is employed in from 70 to 80% ll dental restorations.

he properties which make methyl methacrylate espe- ly adaptable for dental uses are its easy moldability by improved method; its strength and ruggedness; and its stance to chemical or physical changes after being in the th for years. A suitable denture material must meet a long list of specific requirements. The acrylic mcets these requirements better than other substances previously used.

In tests conducted on all dental plastics by the National Bureau of Standards at Washington under the supervision of the American Dental Association and its research staff, the performance of the acrylic was measured against that of vulcanites like olive base rubber, of phenol formaldehyde formulations *(Densene, Duratone,* and *Luxene 37),* and of vinyl resins. The results of the investigation indicated that the methacrylates have a transverse strength equal to, or better than, that of rubber. They were found to have greater tensile strength and indentation hardness. Shrinkage rate is approximately the same, but moisture-absorption is greater. In all properties excepting moisture-absorption, the methacrylates were found to be generally superior, also, to the phenolics and the vinyl resins.

Another series of tests conducted at the Northwestern University Dental School Testing Laboratory was reported at about the same time. The findings indicated that although the methacrylates investigated were less resistant to impact, they equalled vulcanite in tensile strength and had only about one-third the "set" (time of hardening).

One advantage of the acrylic is that the equipment needed to process it is relatively low in cost and easy to handle. This enables dentists to do their own laboratory work if they so desire. Methacrylate dentures are comparatively easy to repair. The plastics can even be used to mend vulcanite and phenolic dentures. Another advantage is its transparency, which makes possible direct observation through a finished replacement so that the dentist can detect compression of tissues, hollow spaces or roughened areas and make needed adjustments.

The accompanying table, presented by W. D. Turner, Professor of Chemical Engincering, Columbia University,

Top half of flask is then foiled (not shown), and flask is put in clamp, immersed in water at 165° F for curing

Upon the completion of the curing period, the plaster in which the denture is held, is ejected from the flask

After ejection has been accomplished and the flask set aside, the plaster is broken away and the foil removed

Finished denture rests on model against which it was molded. (Process photos courtesy Vernon Benshoff Co.)

These dentures, made from "Plexiglas" molding powders, possess good dimensional stability, and are hard and strong

gives the rating of dental methyl methacrylate, vulcanite, the phenolic resins and polyethylene in relation to a list of denture requirements.

Characteristic	Vulcanite	Phenolics	Acrylic	Polyethylene
Non-injurious to mouth tissue	O. K.	O. K.	O. K.	O. K.
Odor		Faint odor.	No odor.	No odor
Taste		Faint taste.	No taste.	No taste
Inert to oral secretions	O. K.	O. K.	O. K.	O. K.
Esthetic appearance	Poor	Good	Very good.	Very good
Tensile strength	Good	Poor	Better	Best
Resistance to shocks	Good	Poor	Better	Better
Hold teeth firmly	O. K.	O. K.	Too tight.	O. K.
Eliminates seepage	Not always.	Good	Excellent.	Excellent
Polish	Poor	Good	Excellent.	Excellent
Can be manipulated easily.	O. K.	Good	Good	Not easily
Can be repaired easily.	Takes time.	Shows color difference	Excellent.	Excellent
Shrinkage or swelling	Very stable.	Good	Very good.	Better
Water absorption	Low	Low	High	Low
Heat conductivity	Poor	Poor	Poor	Poor
Weight	Light	Light	Light	Light
Dimensional stability	O. K.	Good	Good	Good
Cost factor	O. K.		High	High
Sales value	Poor	Good	Excellent.	Excellent

Acrylic teeth, saddle on gold frame made by Acralite Co.

While not an ideal denture base material, the acrylic is by and large the best available, in the opinion of an increasing number of dentists. They point out that it is very stable under the conditions prevailing in the mouth. After curing it does not lose volatile materials as other resins do, and thus does not warp and change in volume. It does swell somewhat when it becomes wet and contracts when dried again. This, however, is not a shortcoming as the denture returns to its original size under the same conditions.

The acrylic material has sufficient strength to withstand the stress of mastication without distortion or breakage. It has high indentation hardness when cured so that the surface is not easily marred by excursions of food over the denture. As to dimensional stability, tests of acrylic sheets showed a dimension change during periods of from 10 days to 24 months of less than 0.1%. This is only 0.05 mm over a denture span of 50 mm.

An important factor in dental prostheses is esthetic appearance. In this regard also the acrylic serves admirably, offering wide possibilities in cosmetic effect. Various degrees of translucency and coloring can be achieved. The texture can be delicately mottled or veined. On the other hand, color permanence can be obtained with inorganic pigments. Again, the plastics can be perfectly transparent if the dentist desires the underlying tissue to show through. Finally, a translucent instead of transparent acrylic can be used to reflect and transmit the color of surrounding regions and the underlying tissue so as to achieve a life-like appearance.

The pigmentation of acrylic resin powder for this purpose is a delicate operation, requiring the closest control if batch-to-batch uniformity of color is to be maintained. Close control makes it possible to match dentures from different batches. In the case of repairs, a good color match can be obtained so that it is difficult if not impossible to differentiate the part replaced. The coloring is fast; acrylic dentures that have been in service for many years show no signs of fading or discoloration.

The use of methacrylate resins for dental prostheses has resulted in certain modifications in molding technique. The acrylic is now produced in two forms, a "gel" in which the monomeric and polymeric constituents have been pre-mixed and as two separate packages, one containing the monomeric liquid and the other the polymeric powder. In the latter case, the operator has to make a dough from the two materials. Precautions may have to be taken to correct the

(*Continued on page* 99)

TENITE...

Tough Stuff—for Smooth Railroading

Toughness under all weather conditions; toughness to withstand hard railroad use; toughness to protect delicate parts inside — that's the Tenite handset case, molded for railroad radio service, that is shown below. The gray surface of the Tenite has permanent luster—requires no refinishing to protect it from moisture, wear, or corrosion.

This handset is molded in three sections, which screw together with molded-in threads. Special mouthpiece design, using two narrow slits, limits microphone pickup to the speaker's voice; noises from other directions are excluded. The rubber earpiece eliminates outside sounds. The handle contains a "push-to-talk" button molded of red Tenite.

The Tenite used for this application is cellulose acetate butyrate, which offers a unique combination of properties that makes it ideal for many products. Easy to mold; economical (no waste); warm to the touch; tough; strong; excellent temperature range; limitless range of colors; available in transparent, translucent, or variegated forms; resists aging, sunlight, and moisture; high dimensional stability.

For molding, extruding, coating—Tenite is the industry's No. 1 thermoplastic. Formulas to fit your needs. For advice on the use of Tenite in your product, please write, stating your problem, to: TENNESSEE EASTMAN CORPORATION (Subsidiary of Eastman Kodak Co.), Kingsport, Tennessee.

Handset for Railroad Radio, molded by Sobenite, Inc., for Electro-Voice Corporation (both of South Bend, Ind.)

Tenite AN EASTMAN PLASTIC

An Eye for an Eye

Improvements in manufacturing and fitting techniques have resulted in artificial eyes which fit better, look more natural, wear easier

Inserting the plastics eye between the lids to check on proper size and positioning relative to the remaining eye

By Major V. H. Dietz
Halloran General Hospital

A NEW all-plastics eye so uncannily natural in appearance and so scientifically fitted that it is generally impossible to detect the true from the false eye when the wearer looks straight ahead at the observer has been developed for the exclusive use of the U. S. Army. It is the result of long and patient research aimed at perfecting the techniques of fitting and manufacture.

The development of the plastics artificial eye was spurred by the threatened depletion of supplies of glass eyes, which came mostly from Germany before the war. Eye injuries or affections requiring a removal of the eyeball frequently occur in war-time. The need for artificial eyes thus made it necessary for the Surgeon General to discover a new source of supplies. The problem was not merely the esthetic one of matching iris colors. Injuries to the eye orbit (socket) frequently cause malformations that present special problems in fitting, and an artificial eye was sought of a type that could meet these requirements better than the traditional glass eye.

After a few months of research and experimentation, the technique had not only been perfected, but the important task had been begun of training officers to carry on the work of fitting and processing at other hospitals. The result was the installation of plastics eye laboratories in military zones scattered over the United States. These stations have been functioning since the latter part of 1944 and, according to reports, the results have been "most gratifying." Reactions from the patients, as well as photographs of the eyes themselves, testify to the superiority of the new prosthetic device over the glass type in esthetic appearance, comfort, and mobility. These results are obtained by custom-fitting the prosthesis to the particular requirements of the patient, with individual adaptation to socket and lid peculiarities, color of iris, size of pupil, and color of sclera (the opaque "white" of the eye which covers 5/6 of the eyeball, the remaining 1/6 being occupied by the transparent cornea in the human eye).

New Process Uses Plastics

In the new process, plastics are used exclusively. Included are the acrylic resins, vinyl copolymer (vinyl chloride and vinyl acetate), and ethyl cellulose, together with rayon fibers (cellulose xanthate).

The first step is the making of the iris and pupil. For this purpose a transparent ethyl cellulose disc is used with a diameter equal to that of the iris of the other eye. The disc is 0.015" thick and is stamped out in the center to form the pupil. The diameter of the latter ranges from 2 mm to 7 mm or more, depending on the size of the other pupil under measured light conditions. The usual diameter of the

ED. NOTE: The author was assisted by Major Milton S. Wirtz and Capt. Stanley F. Erpf. These three men had been engaged in independent pioneering work before they were brought together at Valley Forge General Hospital to pool their knowledge and to collaborate on further experimentation.

MEET A POSTWAR CLEANER

it's new . . . it's plastic . . . it's in color

THE EUREKA VACUUM CLEANER is depending on materials teamwork to maintain its position as one of the country's leading household appliances. This new and improved home cleaner makes strategic use of both thermoplastic and thermosetting plastics as well as light metals and other materials. Thus the specific advantage of each material is utilized to the utmost.

Celanese plastics: LUMARITH CA and LUMARITH EC supply dent-proof toughness and surface permanence to the injection molded suction nozzles, hose connections, switch key, name plates, handle and cord clip.

Because of plastics, the Eureka makes its postwar debut in "technicolor" . . . The present model is a deep maroon—a color that adds quality and distinction to the workmanlike design.

Celanese is headquarters for cellulosics — the most widely used plastics for consumer goods. The technical service staff can be depended upon for accurate and practical advice on product planning of this type. Celanese Plastics Corporation, a division of Celanese Corporation of America, 180 Madison Avenue, New York 16, New York.

Celanese* Plastics

FORTICEL† *Cellulose Propionate* LUMARITH* *Cellulose Acetate*

†Trademark
*Reg. U.S. Pat. Off.

CELLULOID* *Cellulose Nitrate* VIMLITE* *Plastic Glazing*

In the formation of a wax shell (made after the button has been completed) to fit the eye socket, ball bearing which is selected as the "mold" possesses a diameter approximately equal to the width of the eye socket

disc itself is from 10 to 12.5 mm, representing the range in size of the normal iris.

Pigments used to paint iris colors on the disc are those conventionally used by easel artists and are of high quality, like the Windsor Newton type. They are painted on with sable brushes dipped in linseed oil. Seven colors are used—titanium white, ivory black, chromium green, cobalt blue, burnt umber, yellow ochre, and cadmium red. Mixtures of these colors in varying degrees are capable of reproducing the shades and colors usually found in the human iris.

One feature of the process is the original method of applying the colors to simulate a living iris, which has several zones of color shades. The chief or background color occupies the zone around the periphery of the iris, called the limbus. Another zone, of the same hue but lighter in color, lies just inside this field. It is called the stroma zone because of the stroma or radiating fibers discernible. A third zone is the "collarette," which immediately encircles the pupil. The color here is generally stroma color plus brown, with delicate radiating fibers showing through. Finally, the individual over-all markings of the natural iris must be duplicated, from small specks to larger, flame-shaped forms, the colors varying from lemon-yellow to brown.

How Color Is Obtained

The uncanny color effect is achieved, in part, by painting the disc on both sides, depending on the zone duplicated. In this way the colors behind blend with those in front and yet remain with their markings in their own plane. This creates a slight three-dimensional effect and simulates the different color planes of the human iris.

After it has been painted, the disc is dried in an oven for several hours, the temperature not exceeding 75° C, as a higher temperature may lead to disc shrinkage. The disc is then converted into an "iris button." This assembly unit consists of the iris, the pupil, and the cornea, which is the

Removing wax segment which matches front dimensions of the eye socket. This illustrates only one of the many careful fittings, measurements in making artificial eyes

nsparent bulge in front of the iris and separated from by an "anterior chamber."

In this process the disc, placed in a precision die made accommodate various sizes, is laminated between two ers of transparent acrylic resin. The plastics on the terior surface is pressed by the mold into a parabolic rve similar to that of the cornea of the normal eye, the rve being the mean of various corneal measurements. The rylic layer on the posterior surface serves in part to hold e pupil disc, which is inserted later, in position.

The precision die used in this process consists of five ainless steel parts with sectional cavities of varying sizes accommodate the different iris sizes. Four diameters e generally sufficient to meet all requirements. The die ates are packed with acrylic resin dough, and the different rts are separated by intervening layers of dry cellophane permit test packing, which eliminates excess material d flash.

The iris disc and pupil disc are inserted in two stages, the ter consisting of jet black vinyl acetate, which resembles e color of a normal pupil so closely that it does not have be painted. It is inserted in the die behind the plane of e iris, and this helps to create the illusion of a living eye. he pupil does not occupy the geometric center of the rneal area but is slightly displaced nasally, as it is in the rmal eyeball.

For greater naturalness, the diameter of the pupil is made conform to the specific lighting conditions prevailing at e time, since the living pupil contracts and dilates in proortion to light intensity. For this reason the intensity of e illumination and the distance of the light source from the eyes of the patient are recorded. After the iris disc is stamped out to provide a pupil-opening of the approximate size, a rat-tail file can be used to widen the pupil a trifle, if necessary. Two artificial eyes can be furnished each patient, a "day" eye and a "night" eye, the pupil of the latter being larger, as it normally is in diminished light.

The assembled die plates are placed in a spring press, which remains tight for a least 20 min. Curing in dry heat at 76° C for 3 hr is the next step. The die is then cooled and the iris button removed.

Besides the parts previously noted, each button has a pro- to mark relative position, acts as an ejector pin for removal truding transparent stem. This stem, beveled on one side of the button from the mold, as a handle to manipulate the wax form of the prosthesis, and as a device to insure proper positioning and alignment of the iris button when it is inserted.

After the button has been completed, a wax form is made, based on the contours of the eye socket. In this process, ball bearings of various sizes are generally used. One is selected that conforms most closely to socket requirements and wax is formed around it. This wax corresponds to the sclera, in which the iris button is later inserted. Repeated fittings in the socket result in additions of wax layers and modifications of the contours to insure the correct form.

A fact to be stressed here is that, in most cases, the wax form is not made so that it duplicates the contours of the eye socket, but so that it can be used as a foundation to hold the eye in position in such a way that comfort to the wearer, mobility of the eye, and esthetic effects are achieved at the

(*Continued on page* 93)

Packing the scleral acrylic, which may be colored in one of 15 shades by inert mineral pigments. Tin-foiled mold holds iris button, which has been accurately positioned

The final step in making the plastics eye is coating it with transparent acrylics to simulate the conjunctiva, the transparent outer coating which invests the eyeball

Notes on Commutator Design

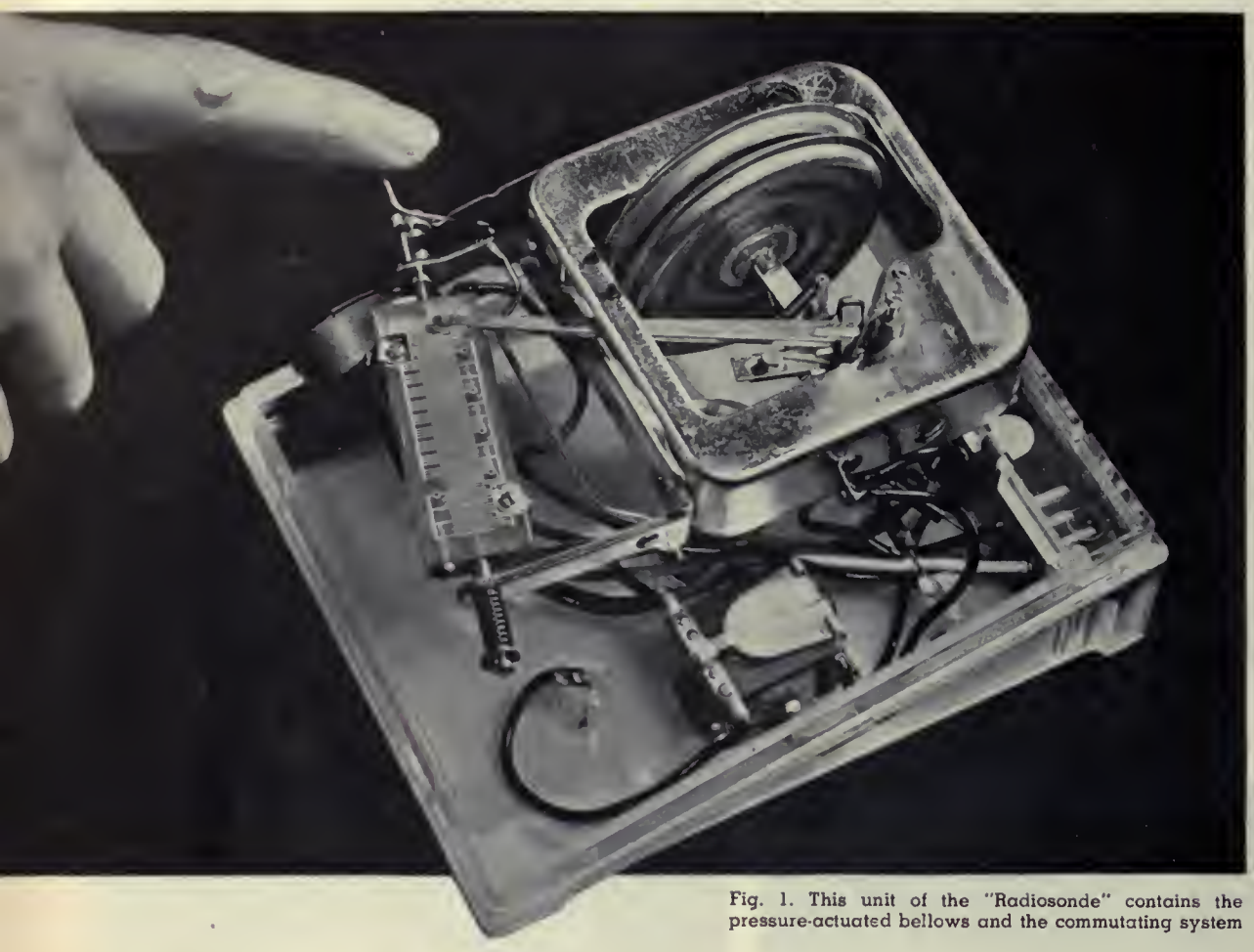

Fig. 1. This unit of the "Radiosonde" contains the pressure-actuated bellows and the commutating system

Metal-plating polystyrene is a speedy and economical way to make commutators of complex shape or with many segments or connectors

By M. A. Prince

Manager of Manufacturing and Engineering, Metaplast Company

IN THE past, whenever an electrical commutator was required for a specific application, it was built up with alternate segments of insulator and conductor, which were then clamped together. The conductor was usually silver or copper, and the insulator mica or a phenolic plastics. Lately, however, other methods of manufacturing commutators have been sought to reduce costs and provide a better product. One of the types so developed is the metal-plated polystyrene commutator.

To make a commutator by metal-plating, a plate made of plastics or some other non-conductor is grooved either by molding or machining at the positions where conductors are desired, and then the whole surface is electroplated with enough metal to fill these grooves. At the same time the metal will, of course, also cover the raised portions. The surface is then machined or ground down until all metal is removed from the raised portions. With these few operations, the commutator is complete. Thus, the need for making and assembling many parts is eliminated.

Whether the conductors or insulators are of equal or unequal width is unimportant, since this is taken care of in the molding of the plastics. An additional advantage of this type of commutator is that the electroplating operation completely fills every space in the groove, thus eliminating unevenness which might cause undue brush wear. Furthermore, if it is required that certain segments be connected, this can be accomplished without any additional operations simply by providing a groove for the connector at the same time the other grooves are formed.

Because it is so simple to produce a commutator by metal plating, this method has often been preferred whenever the commutator required a large number of segments, or the segments were of intricate shape, or many connectors were required between segments.

A commutator manufactured by this technique was developed jointly by the Johnson Service Company of Milwaukee and the Metaplast Company of New York, for use in the *ML-310 Radiosonde-Modulator*. The *Radiosonde* is an in-

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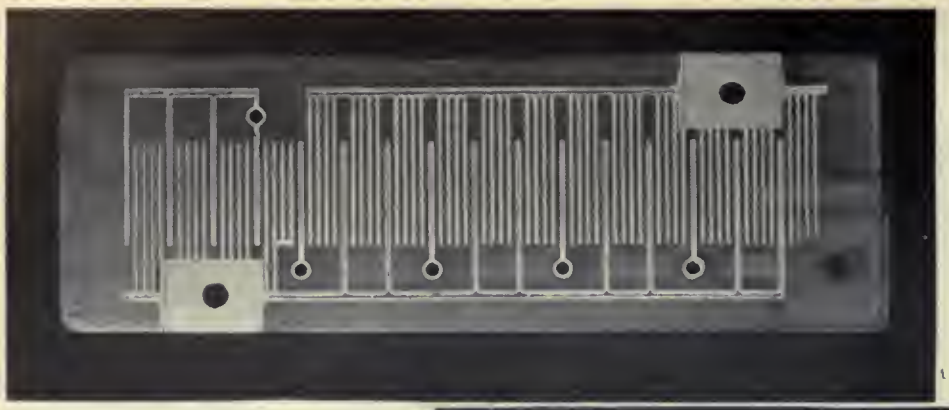

Fig. 2. Front view of commutator shows commutating segments, two connecting circuits. The transparent material allows a "phantom" view of rear mounting holes and third connector

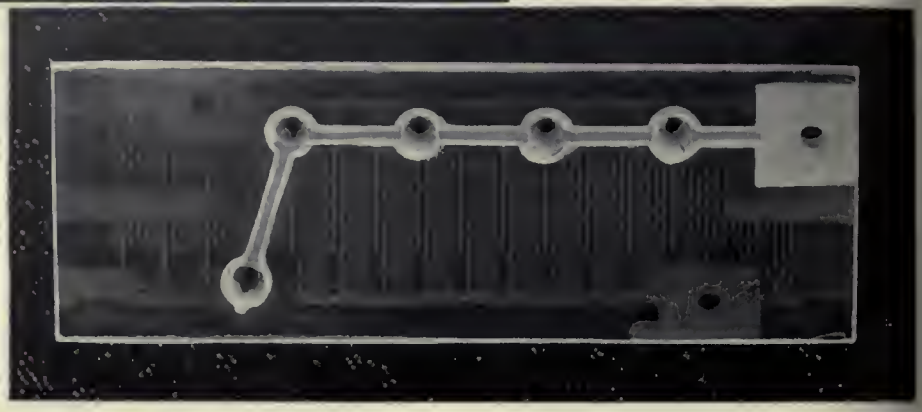

Fig. 2a. The rear view of the polystyrene commutator shows the third connector and associated tapered holes. The connection lug is screwed on at square in upper right corner

strument which is sent up in the air, attached to a small free balloon, and, as it ascends, broadcasts the relative humidity and temperature at various altitudes to a receiving station on the ground, by means of a tiny radio transmitter. This type of instrument is used extensively by the armed forces and the Weather Bureau to prophesy weather conditions throughout the world. During the war, when knowledge of atmospheric conditions in enemy territory was required, *Radiosondes* suspended from small parachutes were dropped from planes.

The *Radiosonde* contains a bellows which actuates a contact arm. As the balloon ascends, the decreasing air pressure causes the contact arm to move, thus making contact with a specific segment of a commutator for each altitude level. Each one of these segments is connected to either the humidity-measuring circuit, the temperature-measuring circuit, or a calibrating circuit. Therefore, as the balloon ascends, the receiving station on the ground gets alternating indications of temperature and relative humidity, and every so often the calibrating or reference circuit indicates whether there has been any electrical drift in the delicate instruments comprising these circuits.

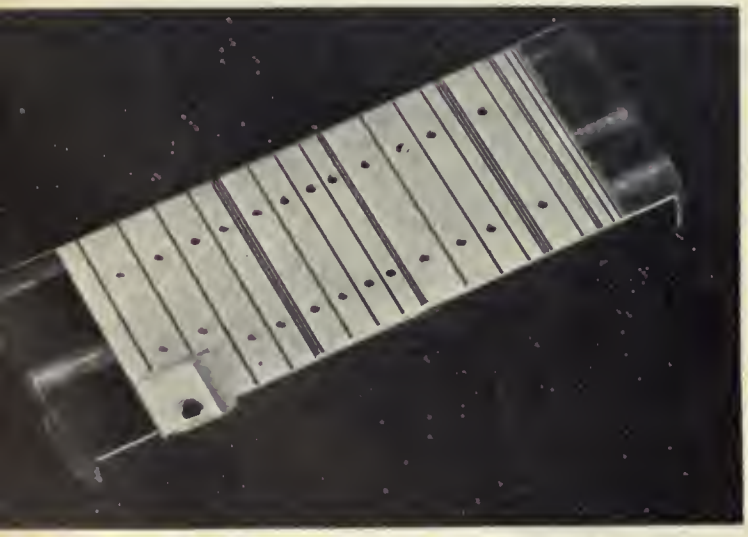

Fig. 3. New method avoids making, assembling many parts

The commutator previously used in such devices was assembled from 80 conducting segments and 81 insulating segments. Most of the conductors were .005″ thick, and some were .010″ thick. Each conducting segment was made integral with its soldering lug by stamping the entire unit from a sheet of silver. The insulators between conducting segments were .015″ thick and were stamped from a sheet of phenolic plastics. Both the insulating and conducting pieces were provided with a hole in the center, and the assembly was made by stacking the conductors and insulators alternately on an insulated screw and then clamping the parts together with a nut on each end. Each one of the conductors was soldered to one of three leads. This assembly was then impregnated with an insulating varnish and baked, after which one side was ground down to form the commutating surface.

The assembly of these commutators required a great deal of labor and, therefore, they were quite costly to produce. The large number of soldered connections caused occasional failure in operation, and the clamping pressure caused the phenolic insulating segments to cold-flow above the commutating surface, impeding the motion of the delicate contact arm. Each *Radiosonde* instrument required a separate calibration, and there was so much variation in the total length of the commutators, caused by the tolerances in the thickness of the conducting and insulating segments, that it was necessary to completely recalibrate the instrument whenever a commutator had to be changed.

In designing the metal-plated commutator, it was relatively easy to provide a connector for each of two of the circuits which was continuous with the proper commutating

nents. This was done by providing a groove on each of the commutating face, each groove being joined to grooves for the corresponding segments. However, the circuit could not be brought out in the same manner, it had to cross one of the others.

rious methods of molding-in the third connector as an t were considered. However, the number of connec- to be made, and their .005" width required the insert e small and intricate. Since this would involve a lot fficulty in locating and maintaining the position of the t during molding, this method was discarded.

solution was found by providing holes from the face of commutator through to the back. These holes were ed to intersect the grooves for the conducting segments e third circuit and were connected to a groove on the of the commutator. In order to be sure that the ng would carry through the holes from the front to the of the commutator, these holes were tapered, with the l dimension at the front. The three connector grooves, on the front and one on the back, were ended in flat s provided with a tapped hole in the center of each, re connections were made to the external circuit with w and soldering lug.

lthough a thermosetting material was considered most rable because of smaller difference in temperature co- ents of expansion between the insulator and the metal, as decided to try methyl methacrylate in the models use of the difficulty of molding the small grooves in luction. The tiny grooves were made with a shaper. er was chosen as the metal to be plated because it has ter throwing power in the electroplating bath than er.

fter the models were plated and their surfaces ma-

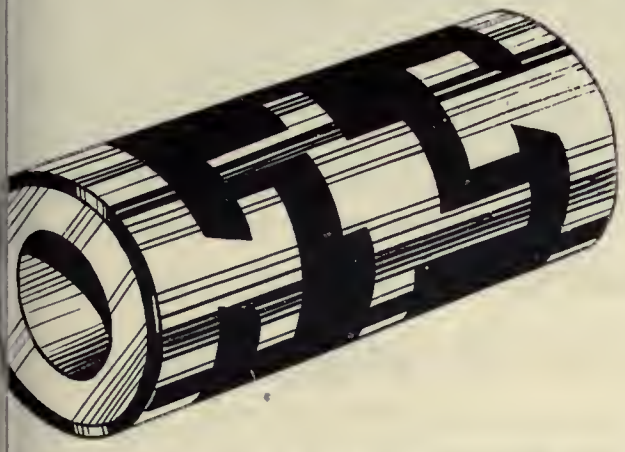

Fig. 4. Intricate commutating surfaces plated into grooves

ned, the first difficulty was encountered in the cold test — 40° F, because the methyl methacrylate shrank so h that it forced the silver out of the grooves. This s remedied by making future models of polystyrene, since as a temperature coefficient of expansion approximately f that of methyl methacrylate. Other tests were made on model at various temperatures and relative humidities ich might be encountered by the *Radiosonde* in service, when these proved satisfactory molds were made to turn the part on a production scale.

When the first molded samples were plated, it was found t the plating did not adhere well enough to remain in all grooves during the machining operation. Investigation closed that the surface of the grooves of the machined dels contained microscopic rough areas sufficient to allow plated metal to lock itself in place. This, of course, was the case with the molded pieces. Fortunately, however, at this time, in a separate research program to improve the adhesion of metal plating to plastics, a chemical treatment was developed which provided a much greater bond between the two. By treating the polystyrene accordingly, the adhesion difficulty was removed and the development was completed.

The commutator, mounted in place in one unit of the *Radiosonde,* may be seen in Fig. 1. This unit contains the pressure-actuated bellows and commutating system, and serves as a mounting for the humidity element which is plugged into the bottom. In operation, the unit is protected by a molded cover of clear plastics, not shown.

Front and back views of the commutator are shown in the photographs in Fig. 2. All the segments and two of the connectors may be seen in the front view, and the third connector and its associated tapered holes may be seen in the rear view. The flat, plated rectangles at the ends of each connector are provided for connection to the external circuit, as previously mentioned.

Fig. 3 shows another commutator made by the same method, used in the *Baroswitch ML-213,* also made by the Johnson Service Co. This instrument is used to obtain information concerning wind direction and velocity at altitudes reached by airplanes in flight. The *Baroswitch* is also attached to a free balloon, but it simply sends out a signal which is interrupted by the motion of the contactor arm as it moves from segment to segment on the commutator. Radio detection equipment on the ground picks up the signal and, by following its direction as the balloon drifts, records the direction of the wind and its velocity. Since the position of the contactor arm is determined by the altitude at any time, the interruptions in the signal give the altitude at this time.

This commutator was previously made by the same method used for the *Radiosonde* commutator, but in this case all of the silver conducting segments were connected to only one circuit. Inasmuch as the segments vary in width from 0.005" to 0.125" in width, and since very few are alike, in addition to the difficulties encountered in the original type of *Radiosonde* commutators, many mistakes were made in assembling the proper segments in their correct sequence.

As can be seen in the photograph, the top face and the sides of the commutator are plated, and after machining the face, the metal which remains on the sides serves as the connector, since the commutating grooves are carried from one side to the other. As in the *Radiosonde* commutator, the flat depressed area is used to make connection to the external circuit. The small holes seen in the large segments are molded-in to provide an additional safety factor against separation of the metal from the plastics in the relatively rough machining operation, since the metal gets an additional grip along the sides of these holes.

In addition to the flat stationary types of commutator,

(*Continued on page* 97)

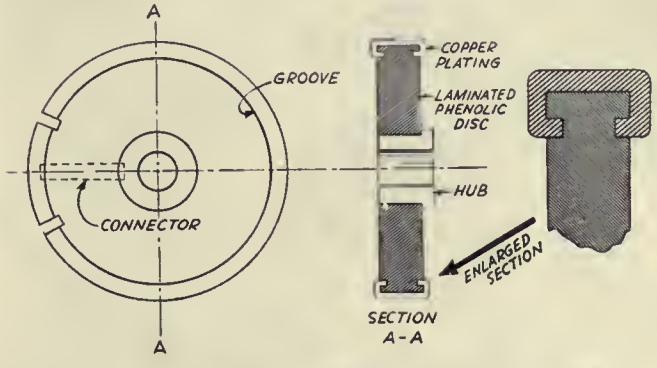

Fig. 5. Disc-type with commutating surface on outside

The Schick "Super" model as it is packaged for market. Years of development—including market research, designing, engineering, improvement of manufacturing technique—have gone into job of producing this shaver

The Schick Shaver —A Case History . . .

A story of creative design and product development, with emphasis on how plastics were engineered into the product

By William Schack
plastics Field Editor

First trial shearing head and first series of cases

NO TERM has a more definite meaning than "product engineering," yet it is often used as loosely as the word "streamlined." Anything smooth and slick is called "streamlined," and many products which look well enough but serve their function just passably are dignified beyond their merits as the offspring of "product engineering." It is to demonstrate creative engineering and creative design at work that we have chosen to make a case study of the electric shaver originated by Schiek, Inc., Stamford, Conn. When we have examined the thought expended on both the functional parts and external housing (which is also importantly functional), and noted how they have changed and developed, how different plastics materials have been used for the same parts at different times, and how the molder has met the challenges they presented, it will be evident why the shaver is truly an example of product engineering.

The idea of the electric shaver came to Colonel Jacob Schiek while he was stationed in Alaska before the first World War. After he got out of the service, he first turned

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ttention to the major functional part of such an apus—the shearing head which could clip tough wiry kers without irritating the skin. If the shearing head led the "brains" of the shaver, the motor which drives ead is its "heart." After Col. Schick had perfected ead, he found to his dismay that there was no motor ercially available which was small enough to fit into chanism which was going to be held and handled in a s hand. He had to turn to a toy motor and work it up it had the requisite power and ruggedness for his pse. Although the shearing head and the motor are the ings" of the Schick shaver, every other accessory part vital function, and since it is only into these parts h plastics enter we are confining this discussion to And they are a story sufficient unto themselves.

begin with, it is interesting to note that the first model chick's electric shaver was not housed in a plastics case, n fact did not contain any plastics parts at all. But Schick recognized the possibilities of the materials began experimenting with them at an early stage, with bject of replacing metal and fiber parts with plastics. developmental work was fruitful; one plastics part another began to be used in his invention.

w to begin our examination of the internal parts. ng a rotating armature, the tiny motor had to have ngs, and problem number one arose: how to support omically two bearings for a shaft having a diameter of ″ and making 3600 rpm. There was, too, the question oise, for this motor wasn't going to operate in a tool but right up close to a man's ear. Heavy lubricants l not be used to muffle its noise, because the person the shaver would not take kindly to the idea of warmhe motor of his shaver as he does the motor of his he was more likely to leave it on the top of the dresser, n open window, and then expect, even in the dead of er, to have the icy motor start running immediately give him his usual three-minute shave. Instead of ng on heavy lubricants, therefore, the Schick company ht the solution to the noise problem in minute clears of the shaft, which is now of the order of 0.00015″. in turn created the problem of bearing alignment.

y Experimentation

Schick's first production model, the bearing support ks were molded integrally with the plastics housing, compression molded bearing caps holding the ball ings to their support blocks. Trouble soon developed: iderable warpage took place after assembly, throwing bearing supports out of alignment. Plastics took the for this trouble, so that on the next model a metal diebearing unit was employed. But this did not prove factory either, much to everybody's surprise. This was subject to binding when it was fastened to its sing. Then, as insulation became a factor, a compresmold was made to duplicate the metal unit in phenolic. lthough by 1935 the Schick shaver was much in de, the Sales Department began to clamor for more and e cutting speed, which could only be effected by reducthe bearing drag still further. Punched laminated nolic end plates with short, pressed-in bronze sleeves e fastened on either side of the field structure by screws. model incorporating this change ran faster, true ugh, but the assembly department complained, and lly, that it made their job much more difficult. What wanted was a single unit to handle, and that gave the gn department a real problem to think about. After h study they fashioned a mechanical unit which lent lf to molding.

This clam-shell shaped piece became more than a mere ring support—it assumed a major role in the manufac-

Evolution of bearing support. At lower left is compression molded bearing cap used in first production model

turing department of the company. Transfer-molded of general purpose phenolics, it was so designed that it enabled the assembly line to produce a sub-assembly which in itself formed the entire mechanical portion of the shaver. As can be seen in the illustration, this bearing support subassembly is composed of the following parts: (1) an actuating lever with a Rogers board bushing (this part, molded from a blank, combines shock and wear resistant qualities with extremely close dimensional tolerances. For this application, tests have shown that the Rogers board can outlast steel); (2) the bearing support proper, already described, with porous bronze bearings pressed in after the part is molded; (3) steel shaft; (4) armature of laminated silicon steel; (5) contact arms with rubbing blocks (this part serves to maintain the gap between electrical contact points. It must have the necessary wear resistance, be easy to fabricate and assemble, and furnish the required insulation. Linen-base phenolic sheet was found best suited for all these requirements); (6) contact arm insulating washer made of paper-base phenolic laminate (it also acts as an oil retainer); (7) starting wheel, molded of urea formaldehyde; and (8) its attaching screw.

Between 1930 and 1946, there was a good deal of experimenting with plastics and die-casting for the bearing support, but the company now feels that the "plus" feature of insulation which results in a reduced number of components is enough to warrant the continued use of plastics for this part.

After receiving a special baking process for "seasoning," this rugged rib-reinforced bearing unit is met by a field unit which constitutes the entire electrical portion of the shaver. Plastics materials also play a vital function in this unit. The condenser box, which serves as a container for the wound unit and wax seal, is compression molded of phenolic. The coil ends (there are two coils in the field unit) were originally made of fiber but are now made of paper-base phenolic laminate. These parts must be rigid, and must stand up under the installation of terminal lugs and the heat applied in a subsequent soldering operation. These coil ends must punch clean without fractures—a result best obtained by heating the material before punching.

At this point mention can also be made of the terminal board which holds the contact pins on which the electric cord is plugged. This part receives some shock, must flex

Dummy armature and plastilene and plaster models—all mark stages in arriving at selection of form for case

slightly and yet withstand severe compression from the riveting over of contact pins. Here again phenolic laminate was found superior to fiber, and it is required for the Underwriters Laboratories' approval.

To return now to the bearing support sub-assembly and electrical field unit. These two sub-assemblies are fastened together to the chassis bed-plate which is molded integral with the housing. The cover is added, shearing heads are attached, the shaver is inspected, and it is ready for packaging.

The laminates and the urea starting wheel mentioned above all seemed "naturals" for plastics, and these materials have proved entirely satisfactory, each in its particular place. There remains to be considered the most obvious plastics parts of the shaver—the case. As early as 1928, Col. Schick was experimenting with a plastics case for his miniature motor. But the housing of the second model of the complete shaver itself was still made of hard rubber, painstakingly carved out of a solid piece by his tool-maker. In 1929 the first molds were made for a plastics case, and the material used for it was cellulose acetate. It was soon found that the design could not tolerate the cold flow characteristics of the acetate, and a switch was made to a molded phenolic case. This proved successful enough to warrant their production by the million until 1938. In that year the company made a change to satisfy the public demand for color.

An extensive survey disclosed that ivory white was the first choice of the public, with burgundy red a distant second. The survey also revealed—what had not been anticipated—that it was the women who bought these shavers for the men, not the men themselves. Apparently preferring bright colors for their own use, the woman liked to equip their men with ivory-white shavers. To achieve the necessary purity and brilliance of color—both of the ivory and burgundy—it was decided to change the material from phenol formaldehyde to urea formaldehyde.

From the sales view, the appearance of the shaver is of utmost importance. True, the consumer demands that it perform its function efficiently, but he is also very sensitive to its looks. And that means that the case must be designed for the maximum beauty. With this in mind, Schick called in an outside designer with a reputation for fashioning consumer articles of beauty—Raymond Loewy Associates who put C. Louis Otto in charge of the development. The procedure followed by these designers was to make a large number of drawings of possible shapes for the case. These were reviewed in conferences with Schick representatives who rejected some and held others for further consideration. The latter were then modeled of plastilene in three dimensions to show what the final product would look like—a result not to be achieved with a single drawing. About ten such models were made up from the preliminary sketches, and perhaps another ten revisions were made before the final form of the case was approved.

The model was then cast in plaster and sprayed to give the finished appearance of the shaver as it would come off the production line. Such verisimilitude is possible because the core of the model is actually a dummy of the mechanism to be housed. It registers its recesses and protuberances, allowing all the necessary clearances for operation. Before being put into plaster, the thickness of the modeling material is tested at all critical points to make it conform to that of the case itself. Loewy's often uses such complete plaster models, or photographs of them with appropriate realistic background, to test out consumer response before the article is put into production. Valuable criticism may be obtained in this way for making revisions of the proposed design.

Design Details

The *Super* and *Colonel* models created by Raymond Loewy Associates were distinguished by horizontal corrugations to facilitate gripping the shaver. The "whiskett" attachment in gold was designed so that it conforms with the flowing lines of the shaver case. Thus, the "whiskett" unit extending down from the ends of the shearing head for about an inch makes an agreeable color contrast with the color of the case itself.

The Schick company believes that, with the existing design, molded phenolic and urea are the plastics best suited for cases. But, with new materials appearing on the market, it is on the alert for possible improvements, and it has set up a special department to try out everything that comes along—as well as some of the older materials which have been by-passed. In process of testing are ethyl cellulose, polystyrene, and four formulations of cellulose nitrate. Whatever the particular plastics chosen for the case is, it serves its purpose because it feels good to the touch, lends itself to varied color, acts as an insulator and is easily produced by molding.

While tracing the evolution of the design of the shaver, we have said nothing about the molding of the various parts. This phase of the engineering of the product will now be considered, as it is carried out by Shaw Insulator Company, which does most of the molding for Schick.

The starting wheel, made of urea formaldehyde, has been molded from pre-forms on a hand compression 36-cavity mold. The operating temperature is 290-300° F; the pressure, 75 tons. Although the production rate is quite high, a semi-automatic mold is now being built by Shaw to make the operation easier and to lessen the chances of damaging the mold. The thin flash between the wheels is easily stripped away by hand, and the flash at the centre of the wheel (covering the hole through which the screw attaching the wheel will go) is routed out.

The molding of the all-important bearing support, which is, as has been pointed out, the focal unit of the entire mechanical sub-assembly, is an intricate job. The problem here is to keep the two lips of the part parallel, and to keep the two bearing sleeves aligned and parallel to the pivot

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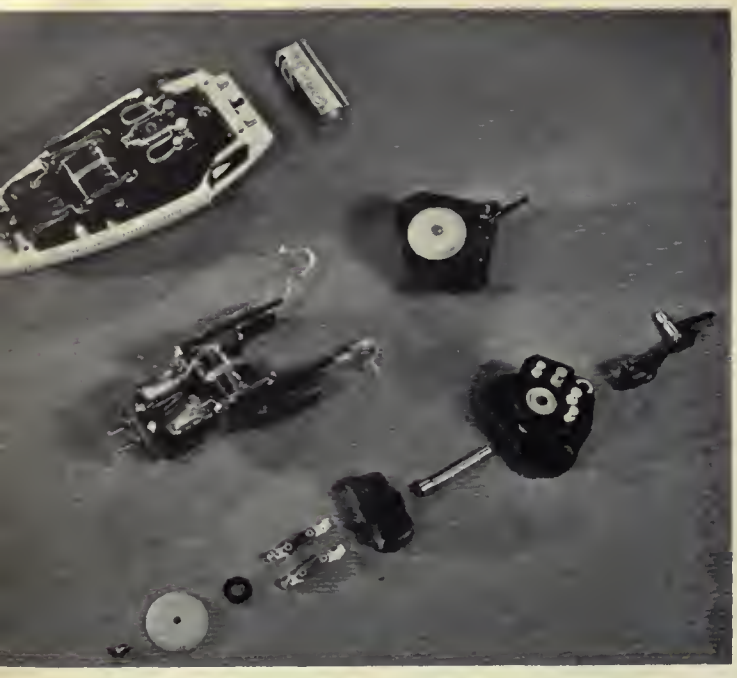


Disassembled views show plastics parts in Schick shaver

stud bearing axis, for the rotor shaft is held by these sleeves. Originally, the part was molded with bronze bearings at top and bottom in place of the sleeves. These were line-reamed without the addition of a bronze liner. Now, after the part is molded, the bearing sleeves are line-reamed and oilless bronze bearings pressed into place. (The actuating arm assembly is attached to the pivot stud.)

Another change called for at an early stage was in the inserts, of which there are a large number in this part. At first brass was used for the posts which retain the contact arms, but it was found that in the process of ejection from the mold they sometimes collapsed, because of their small diameter. A switch was therefore made to steel posts, increasing the diameter 25%, and these were shouldered to prevent the molding compound from filling in the slots

Molds and accessory parts for the bearing supports

provided for the holding of the contact arms. The shoulder on these inserts also determines the distance which the post projects above the body of the part. This is important because they hold the contact arms, which must be in strict alignment to secure proper electrical contact.

The latest design of the support incorporates reinforcing ribs, increased thickness of the lips and increased radius of the bar forming the vertical section between the lips, of which the sharp corners have been eliminated. All these steps were taken to control warpage of the part, for the opening between the lips must be held to 0.005".

To produce these parts, the transfer molding process is used, special precautions having been taken to allow an equal amount of pressure to be exerted in each cavity. Each sprue takes care of two cavities, and each cavity has two gates so as to avoid distortion of the post inserts, the location of the bearing sleeves and the holding pins of the pivot stud inserts. The arrangement also insures a uniform flow of the molding compound.

Molding the Case

The molding of the case, which comes in two parts, is another exacting job. At first they were produced in a four-cavity hand mold, but in inserting the end-jaw plugs the mold was often damaged. It was therefore redesigned for three cavities, and the operation made semi-automatic. The new design was labor-saving, since it dispensed with the molder's helper who moved the hand mold from the loading platform into the press and loaded the inserts. With the semi-automatic process, a special insert loader was devised which greatly facilitated the task. All the inserts are placed in the loader during the cure portion of the cycle and then transferred into the cavities with a single quick operation, greatly reducing the open time of the press.

Now the press is fitted with automatic cycle timers which close the mold, breathe it (allowing ammonia and water vapor to escape), and, after a pre-determined cure time, open the mold and eject the parts. It was found that a clock controlled cycle which accurately times the rate of close and time of cure reduced flow lines and porosity loss to a minimum. The semi-automatic set-up also provided better temperature uniformity (via steam channels), since the hand molds were merely heated by conduction, from contact with the steam platens of the molding press.

A major source of trouble in the production of the case arises from contamination of the pre-forms. Any air disturbance in the area where the compound is being preformed or molded, the dust content of the air, any colored powder lying about uncovered can spoil the purity of color of the product. If inserts are not completely free from grease, oil or brass chips, contamination results. By changing the insert design from diamond knurl to roll thread knurl, the hazard of embedded chips was eliminated. This latter change also facilitated the cleaning of the inserts by dipping in acetone, nitric acid or other agents.

The first step taken to avoid contamination was to enclose the pre-forming machine in a separate chamber, the air of which is constantly filtered. But even the storing of the pre-forms in containers is a source of spoilage. It has been found that boxes lined with cloth-base phenolic laminate are safest, though even these liners rub off a bit.

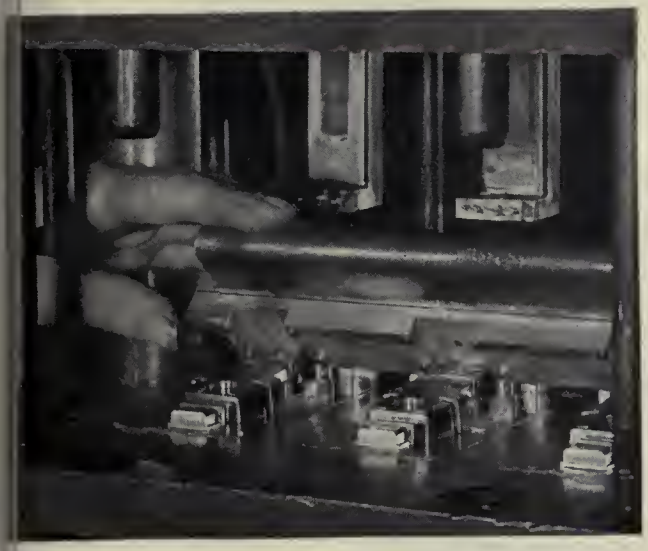
The handling of the pre-forms before processing is of the utmost importance. "Hands off!" is the rule, for an operator working a valve or the insert loader may get dust or grease on his hands which would mar the material. He must therefore pick up the pre-form with forceps both when he puts it on the loading tray and when he transfers it from the tray to the mold.

The finishing of the case is accomplished by conventional

(*Continued on page* 70)

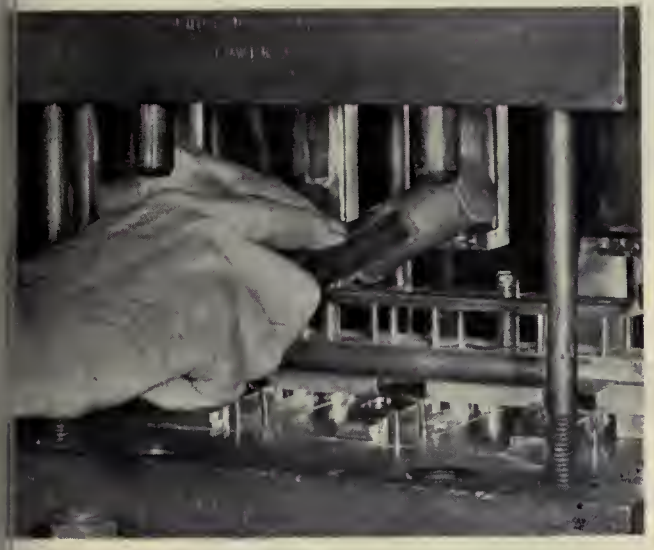
MOLDING and FINISHING the CASE

(at Shaw Insulator Co.)

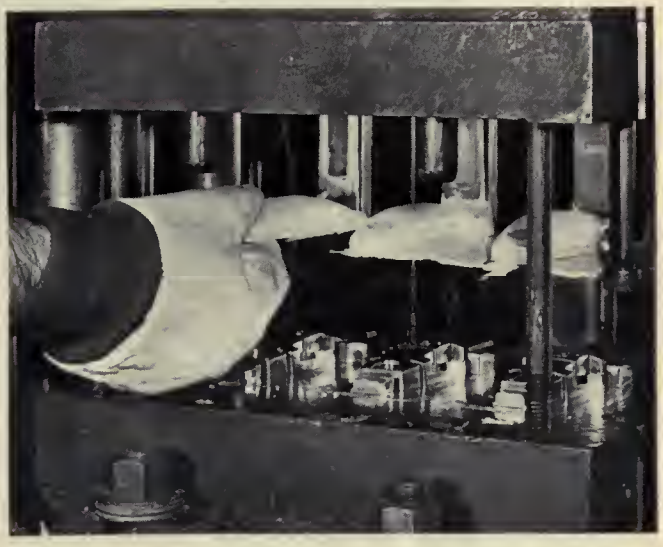


Dies for three-cavity compression mold are here shown close-up with the insert loader being held above them

Preform, which demands most careful handling, is taken from loading table with forceps and placed in the mold



Inserts are here being hammered down from the loader, which has been loaded during cure portion of the cycle



The molding cycle has reached the final stage, and the molded cases are shown supported by the actuating bars

The outer flash on the case is here being removed in the conventional way by use of an endless belt sander

The final polishing is done on a 12-inch air-cooled buff on which a polishing compound has been applied

The Ark That 'Tenite' Built

How an idea for a product developed, through choice of material, design, manufacture and assembly, into a colorful, attractive toy

By V. E. Gibbens

plastics Associate Editor

ONE of the most interesting new toys appearing on the counters during the past Christmas season was a plastics Noah's Ark complete with Mr. and Mrs. Noah, six pairs of animals, and a white dove. A center of attention and curiosity from the time it went on display, it proved so attractive to the many shoppers who came to look that they stayed to admire—and buy. There was an increasing volume of sales.

The Ark resulted from a decision of the officials—notably Charles E. Russell, president—of Amatoy Corp., Chicago, to develop not just any toy but a high quality plastics toy. The aid of all the buyers of the Toy Department of Marshall Field & Company, Chicago, was enlisted in the project, first in the selection of the toy, and then, when the choice had been made, of the colors to be used. These preliminary problems out of the way, there remained the job of modeling the Ark and the animals, designing and building the molds, and choosing the materials from which the various parts and figures were to be molded.

The *Tenite* sheet stock for the original models was supplied by Tennessee Eastman, which had co-operated closely on the development from the start and which was to continue its co-operation. Mrs. Latham, an artist employed by A. Steven Lewis, who undertook the required art work on the project, made the models for the Ark, and Jack Gilchrist, vice president and chief engineer of Amatoy drew up the original designs for the molds, the original planning and development work having been done by the Russell Engineering Co., Chicago. Agnini and Singer manufacturing jewelers, were called in to finish the models for the figures and animals, after the original models had been made by Laura Bannon, an artist. Undercuts were eliminated, and extreme caution was exercised so that the parting lines would not fall in one plane.

Aiding Mr. Russell and Mr. Gilchrist by helping solve mold design problems and by directing the making of molds for the Ark (excluding the figures) were J. C. Kazimier and his staff of engineers from Amos Molded Plastics, Edinburg,

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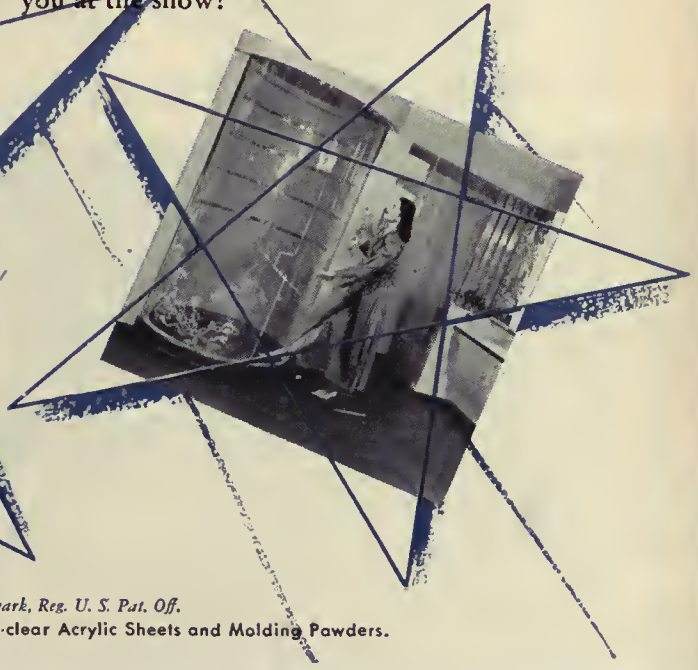

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Here are three steps in manufacture of the Ark proper: left, clamping molded halves of hull as part of gluing operation; center, milling hull to eliminate rough edges and to give specified contours; and, right, testing for leaks in glue line

Indiana, which had been engaged to do the molding of all parts of the novel toy except the figures. Besides the designing of the molds, it was also necessary to adapt old fixtures or design new ones for the assembly of the various parts of the Ark, and to lay out a production assembly procedure. This again was a co-operative enterprise, under the general direction and supervision of Mr. Russell and Mr. Gilchrist.

Tenite I cellulose acetate was chosen for the parts of the Ark itself, which include the dry-dock on wheels or cradle on which the Ark rests, the hull or Ark proper, and the deck house or cabin, the latter including a detachable roof which doubles as a gangplank. This material was selected because of its luster, colorability, water repellent quality and especially because of its ability to withstand the abuse normally to be expected from children two to nine years old, the age group for which the new toy was designed and planned.

After hull has been tested for leaks, an extruded deck seal is glued over deck joint as an added safety factor

Animals Made from a New Plastics

For Mr. and Mrs. Noah, the white dove, and the animals a new plastics was developed known as *Iolaite*. The only information released about this new material is contained in a sales notice of the Ark which declares that figures made from it "are tough and will not break unless subjected to sharp blows."

The Ark measures about 19" from bow to stern and 5½" in the beam. It is "a bathtub-going vessel," the buoyant *Tenite* hull being given stability by metal ballast.

The Ark with the attendant figures and animals presents a colorful picture. The dry-dock is dark brown with red wheels; the hull is of the same brown as the dry-dock; the towline knob, red; the cabin, white; and the combined cabin roof-gangplank, red. Mr. and Mrs. Noah and the animals exhibit varying pastel shades of tan, pink, blue and other colors, and the dove, of course, is white.

Both the dry-dock and the hull were molded in a 24 oz Watson-Stillman injection molding machine. The dry-dock is ribbed on the under side to give it both rigidity and great strength at a minimum of weight. It will easily support a 200 lb man, and thus is sturdy enough to remain whole from the most ferocious banging around that Junior can give it. It is equipped with four red wheels, molded separately, giving it the appearance and general function of a small wagon. A string to which is attached a red *Tenite I* knob provides a means for pulling it. It is slotted so that the hull may be fitted into it and be held upright.

Construction of the Hull

The hull was molded in two parts and later glued into one piece by an adhesive consisting of acetone in which *Tenite I* had been dissolved. Ribs on the inside surfaces of the hull, as on the bottom of the dry-dock, and serrations on the outside surfaces are designed to give it increased

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EPHYR ELECTRONICS, 32 W. Randolph Street, Chicago, Ill.

Girl is prepared with airbrush to give Mrs. Noah's dress a spraying of pastel pink as first step in painting her

rigidity and strength, and a one and a quarter pound steel plate is set into the keel for ballast to make the Ark ride upright in water and to prevent it from capsizing. To make for a secure union of the two parts of the hull and to resist any shearing action tending to disrupt the glue joint in the most susceptible direction, each half was molded with a projecting lug and a recess, so that the two parts could be, in a fashion, "mortised" together. This provision was made along the keel, and an extruded deck seal was used to supplement the binding force of the top or deck joint.

After being removed from the clamping fixture in which it was held while the glue set, the hull was milled to remove all rough edges and to provide specified contours, especially at the "necks" at each end of the boat.

After the hull was assembled and glued, six small holes were drilled in the deck for attaching the six supports of the cabin. Before the cabin was attached, however, the hull was "dunked" in a tub of water to be tested for leaks. The device which did the submerging pressed down firmly over the six holes so that they would not let water seep through into the hull. Simultaneously, compressed air was fed through these holes by way of the submerging device to make sure that the slightest leakage would be discovered. If air bubbles appeared around the glue lines in a hull, it was rejected and scrapped. If non-leaking, it was passed on to the next step in the assembly line.

The construction of the dry-dock (or cradle) shows why it is so rugged despite its comparatively light weight

Sealing the Deck Joint

This was the gluing of an extruded strip over the deck joint of the halves of the hull. A special fixture provided pressure on the strip until the adhesive had set. Then the hull passed along for the installation of the cabin. A clamping fixture held the cabin in firm contact with the deck. After a short curing time for the glue, the combined hull and deck were inspected and then brought together with the removable roof panels and the dry-dock, and the assembly was ready for shipment to Amatoy, where the animals were painted and the complete toy was made ready for final shipment to the store where it was to be put on the counters for sale.

The operation carried on at the Amatoy plant consisted of eight steps: (1) initial inspection of figures, (2) dye-dipping to give them a base color, (3) mounting them on pedestals preparatory to painting, (4) painting, (5) lacquering, (6) drying, (7) final inspection, and (8) packing in special cellulose wadding to prevent abrasion during shipment. For efficiency, a run was made on only one figure at a time.

The handling of Mrs. Noah illustrates the process, except for the dipping—Mr. and Mrs. Noah (and sometimes the dove) being the only pieces not given a base color. After inspection and mounting on a pedestal, Mrs. Noah was taken up—still mounted—by the first painter, who used a *Paasche* airbrush to paint her dress a pastel pink. A second worker sprayed a pastel blue on her head-dress and the earthenware utensils she was taking into the Ark with her. Then after a brief drying period, a third worker sprayed a coating of clear lacquer over the entire figure and set it on an endless belt which carried it through a miniature tunnel into which a fan sent a current of air to aid in quick drying the lacquer. At the end of the tunnel, the piece was ready for final inspection and packing.

Providing Essential Characteristics

Durability was stressed as a major requirement in the original choice of the toy to be manufactured and marketed, in the choice of material, and in the design of the Ark. One of the early hand-made test models was placed in the hands of a small boy, and his treatment of the toy was closely observed. It was noticed then, and has been since, that one of the first things a child does with the Ark is to put it in one position or another and sit on it.

Other characteristics of importance to the toy are water repellency and dimensional stability, and both of these properties appear to be satisfactorily provided by *Tenite I*. Furthermore, the plastics and the paints and lacquers used are non-toxic and non-injurious in any way to the child who may put an animal's head into his mouth or try to bite a piece out of the Ark.

One of the interesting features of the Ark is that it is really three toys in one. The dry-dock or wagon is a toy in itself, as is the boat, and the set of animals can be considered a third. END

Using Vinyl Films for Decorative Edgings

By Betty Frank

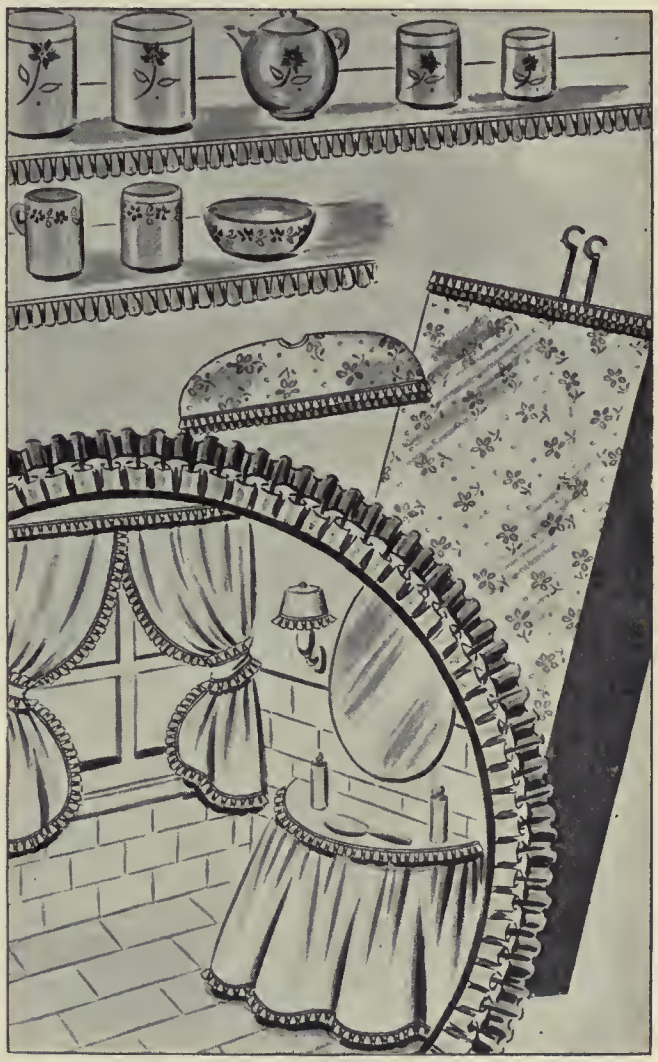
RUFFLINGS and edgings of plastics film are now being marketed by Oppenheimer-Feis Co., New York, and to judge from the public response to their introduction by Macy's in New York, they may find their way into millions of American homes. At present available in twenty-four colors, these potential best sellers are said to be eagerly sought by stores throughout the country.

Some eight months ago, Irving G. Oppenheimer saw the advantages of using in the manufacture of shelf edging for bathrooms, kitchens, and closets a material possessing durability; resistance to raveling, acid, mildew, and dust; freedom from odor; and non-flammability. He found these qualities in *Wataseal*, a film manufactured by Harte & Co. from polyvinyl chloride. Experiments showed that the film lends itself best to handling at a thickness of approximately four or five mils. About four months after experimentation began, color was added to the clear film, and a variety of prints will also soon be available.

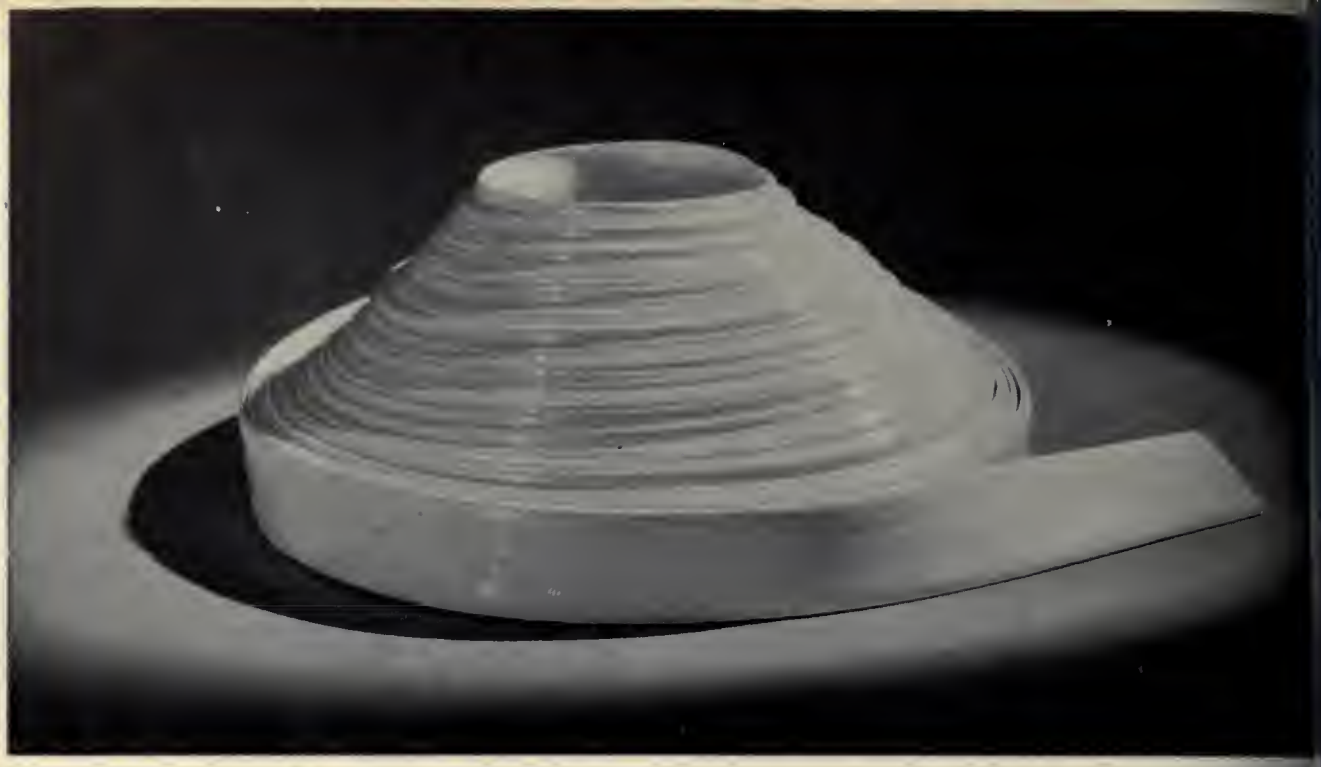
The film, bought in thirty-six yard lengths, is cut and processed by the same machines used to make non-plastics edgings. Simple adjustments in the pleaters and binders have made it possible to run vinyl films without difficulty. The problem of heat generated during the cutting has been solved by separating all yardage with layers of paper, which prevents fusing of the fabric.

Trimcraft, as the edging made from *Wataseal* film is called, is already being turned out in quantity. To apportion and distribute available supplies, the manufacturer arranged to send initial shipments to the leading department store in each key city, where the product was to be previewed and sold during a four-week period, before being generally released. When that period was up, about 1500 top stores

(*Continued on page* 90)



Some suggested applications for "Trimcraft," a polyvinyl chloride "Wataseal" trimming, are in edgings for women's aprons, bathrobes, playsuits, and bathing suits and also for shelves, garment bags, lamp shades, curtains, and dressing tables



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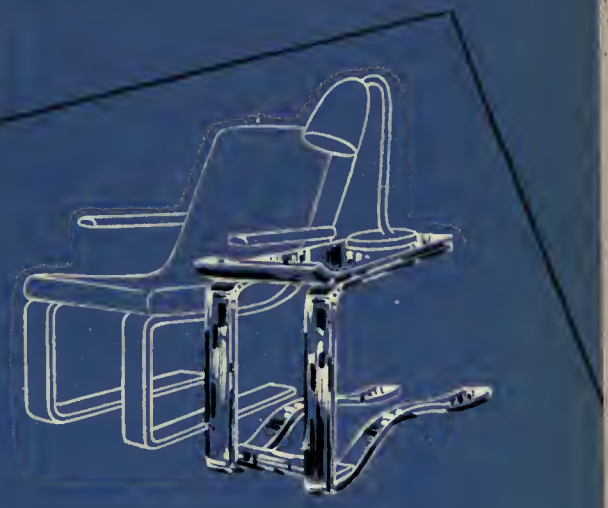
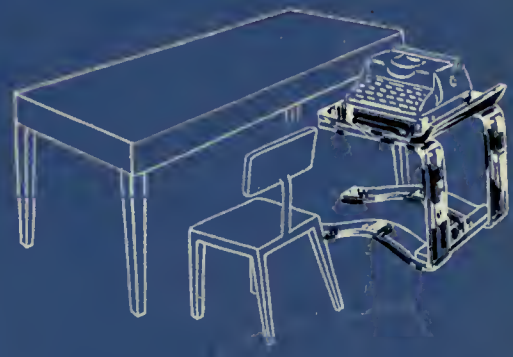
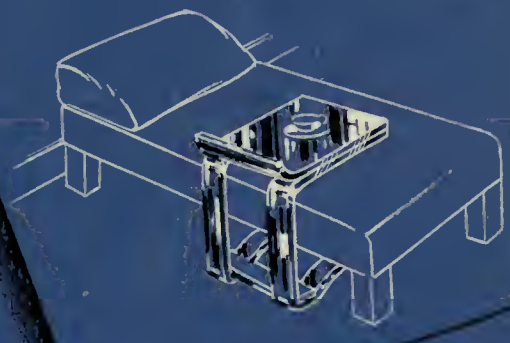
Drawings by Julian Krupa, *plastics* Art Staff

A Presentation of the Potential Applications of Plastics as Visualized by Industrial Designers

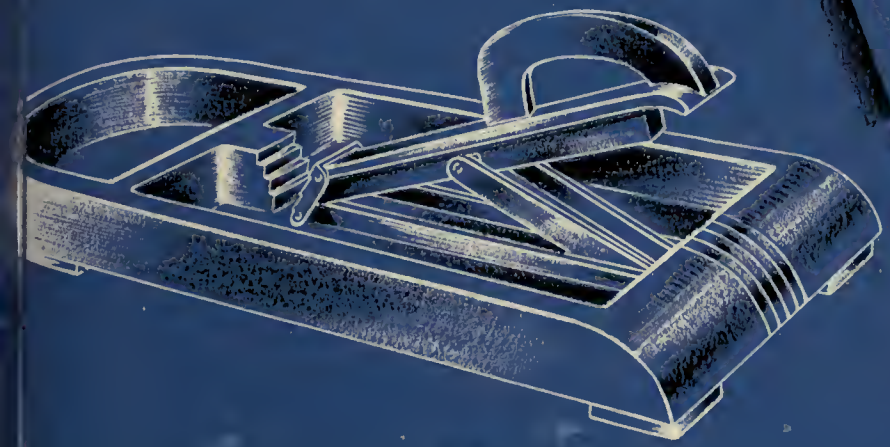
(*plastics* welcomes designers' contributions to this department)







"Adap-Table" is the name chosen by its designer, Kim Hoffman, New York, for this table which has a variety of uses. Constructed of light-weight, sturdy plastics, its ingenious design permits its adaptation as breakfast or bed table, end table, "desk annex," and in a number of other uses where its convenience, attractiveness, and minimum space requirements are assets.



Among features of an all-plastics nutcracker are molded-in compartments for shells and nut-meats, and easy, quick, convenient operation. Note molded suction cups on base. Andrew C. Karlstad, Sherman Oaks (Los Angeles), the designer, suggests making it of a high-impact phenolic.

This injection-molded faucet is said to have been the only civilian item made from polyvinyl chloride during the war

Part I. A first-hand report from a member of plastics team dispatched to Germany in the summer of 1945

This series on the German plastics industry possesses the praiseworthy characteristic of supplying interpretation and well-grounded opinions along with the facts. In this respect, it differs from earlier published reports which consisted of interminable facts and statistics in which the gold and the dross were inextricably mingled.

The series will be noteworthy because of the author's clarity of discussion, his careful choice of fact, and, even more important, his elimination of irrelevancies. It is based on one of the featured talks made at the recent SPE meeting in Detroit.

That some of the photographs with the article do not meet commercial standards is due to their having been taken, in Germany, under most adverse conditions.—ED.

An Interpretative Survey of German Plastics Fabrication

Canteen, molded from "Igamid" artificial leather, was carried by miners and troops

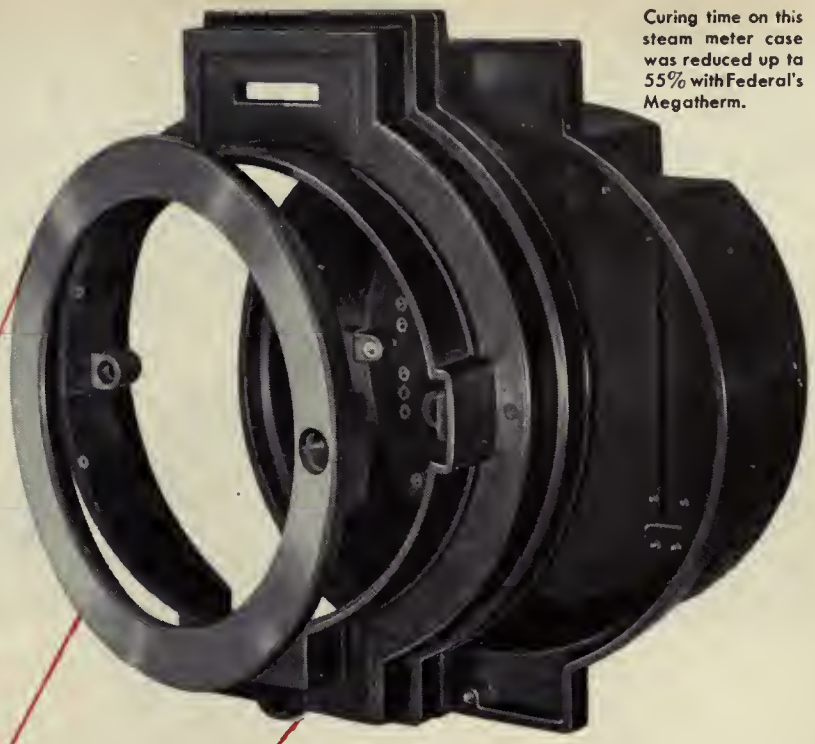
By W. C. Goggin
Manager, Plastics Development Division
The Dow Chemical Company

KNOWING that the Germans had made extensive use of their plastics industry and its products for military purposes, the Quartermaster Corps, whose Research and Development Division meritoriously engineered plastics into many useful military applications during the war, dispatched a team of plastics consultants to Germany during the summer of 1945 to study the German plastics industry, its methods of fabrication, and its military use of plastics.*

Noteworthy—in some cases, outstanding—advances were found in research, applications, fabrication, and production. In this report some of the interesting fabrication methods and applications will be considered. The size and the scope of this phase of the German industry will also be discussed and, where noteworthy, compared with U. S. practices.

Production of basic plastics materials in Germany was largely in the hands of one mammoth company, I. G. Farben. This fact, so different from the competitive situation that exists in the United States with more than a dozen large suppliers, made for some basic differences that greatly affected the fabricator. The German fabricator, confronted with a supply monopoly, had to contend with low quality, contamination, non-uniformity, and high prices. Occasionally, he could do something about it—he could install magnetic separators, granulation screens, special drying equipment, and other devices to improve the quality of the

* Ed Note: The team consisted of Mr. Goggin, J. M. DeBell of DeBell and Richardson, and W. E. Gloor of the Hercules Powder Company.



Curing time on this steam meter case was reduced up to 55% with Federal's Megatherm.

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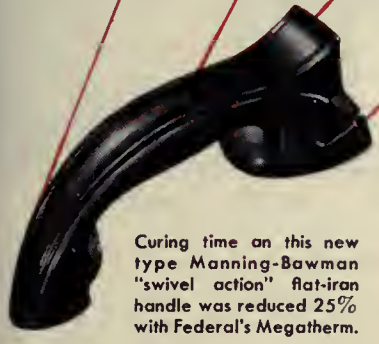
Take the experience of the Watertown Manufacturing Company of Watertown, Connecticut, for example. Using Neillite, their own plastic material, curing time on the flat-iron handle shown here was *cut 25%*. For the large, compression-molded meter case, *curing time was reduced up to 55%*. What's more, with Megatherm heating, the case was molded in a *smaller* press than normally used!

Uniform heating with Megatherm means uniformly excellent plasticity in preforms . . . results in lower molding pressure requirements, in easier flow to all recesses of mold . . . saves dies . . . permits complex parts to be processed with precision. Write for details.



Curing time on this new type Manning-Bawman "swivel action" flat-iran handle was reduced 25% with Federal's Megatherm.

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These are typical injection molding dies with manually removable cores for gasmask parts. (Picture by Capt. G. S. Nalle.) Although credited with the introduction of injection molding, Germany has lagged behind the U. S.

product. But in other cases he was helpless—he could not improve the yellow color nor could he change the basic product chemically. However, he was operating in a market in which the demand exceeded his ability to supply.

The IG industrial monopoly had some merits for the fabricator. The co-ordinated and extensive IG research resulted in a continual outpouring of a wide variety of new products and enabled the supplier to offer the fabricator more help with technical problems than otherwise possible.

Many cases were found where the material supplier was also a fabricator, thus competing with his customer—further indicating the extent of the existence of monopolies. The Dynamit A.G. (Venditor) plant at Troisdorf is an example of a supplier engaged in fabricating to varying degrees depending on the product involved. This plant was controlled by IG and was largely its plastics selling agency. It sold both directly from its Troisdorf plant, and through sales agents located in all large German and other European cities. Its business in 1944 amounted to 45 million pounds or about $30,000,000 (a mark valued at 30 to 35c). The high average price per pound (approximately 67c) results from the fabrication of some products.

The fabrication policies of this plant were inconsistent (see accompanying table). In some cases, the product was merely colored and sold as molding powder (polystyrene). In others (as with phenolics, polyvinyl chloride, etc.), the product was first manufactured, and then a part of the production completely fabricated and sold as tubes, sheet, extrusions, or as custom molded items, while the remainder was sold as molding powder. On a value basis, about 45% of the output was in finished items.

German plastics production was large, especially when compared to U. S. production on a population basis. The yearly production in 1943 was chosen for comparison because German industry had not yet been heavily damaged by bombing. It must be remembered, however, that both productions, but principally the German, represented a highly geared military economy. Germany had been at war for years while the U.S. was in its second war year.

It is, of course, impossible to discuss here all the various methods by which these German plastics products were fabricated. They appear as varied and ingenious as the methods used in this country. Injection molding, compression molding, extrusion, paste casting, and manufacture of film and sheet, of certain fibers, and of foams will be discussed briefly.

Injection Molding

The injection molding industry in Germany consisted of about 350 companies and a total of 1500 injection machines. Many of these companies did injection molding incidentally to their other business. The total injection capacity was

Fabrication in the Dynamit A.G. Plant

Product	Starting Raw Materials	Operations Done by This Plant	Items for Sale
Phenolics	Phenol formaldehyde, normol fillers, modifying agents	Make PF resins and molding powder; PF impregnated paper; laminated sheet stock; rolled tubes; custom molding	Phenolic resins; phenol molding powder; phenalic-impregnated paper, sheet stock, and tubes, custom-molded articles
Polystyrene	Polystyrene, coloring agents, stabilizers	Color and grind only	Polystyrene for molding or extrusion
Polyvinyl chloride	PVC, coloring agents, stabilizers	Coloring; calendering sheet; extruded rod and tubes (*Vinidur*); molded proprietory items (*Vinidur*); molded custom items	Uncolored and colored PVC; calendered sheet; extruded products; molded proprietory items; molded custom items
Cellulose acetate	Acetate flake, coloring agents, plasticizers	Coloring; cast sheet; molded sheet	Colored materials for molding and extrusion; cast sheet; molded sheet

The extent of fabrication of the Dynamit Troisdorf plant is here indicated by a consideration of a few of its products.

(Translucent table lamp, molded for All-Lite Manufacturing Co., Chicago)

Plastics . . . *in a new light*

This lamp, a new departure in household illumination, also casts its light on our molding versatility. It serves as an excellent example of the ideal combination of beauty and functional dependability possible through the *correct* use of plastics. The lamp radiates light the entire length of its translucent shaft instead of just from a conventional type bulb at the top. Its design, while beautifully simple, required a high degree of our imagineering* skill to execute.

If you have a product with a new departure—a product that would reach its highest degree of excellence through the *proper* use of plastics, bring it to us. The result will bring you plastics in a brilliant new light.

*Imagination plus engineering skill.

Write on your letterhead for the new Injection Molded and Extruded Plastics catalogue. Or, for detailed information about MILLS PLASTIC* pipe, tubing and fittings, write for circulars containing data and illustrations.

*Trademark Reg.

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No matter whether you have ever built a boat, build the neat, sleep-four cabin cruiser pictured above, in your own garage, in a few weeks, at a small fraction of what it would cost you to buy any comparable boat.

Credit Doane Marine Works with the idea, and the execution of it. They sell kits containing the easy-to-read-and-understand plans, numbered, pre-cut and pre-formed parts, and all the materials required. *Anyone* can build one.

Featuring modern wood engineering — pound for pound stronger than metal — the boats are assembled of plywood and laminated wooden structural parts. A PENACOLITE adhesive packaged by Doane as Doanite B-9 is included in each kit for use as the bonding adhesive. Nails are used in construction only as clamps.

We think this speaks eloquently of PENACOLITE adhesives. For their results: strength up to 3500 psi; waterproof, weatherproof, boilproof; resistant to molds, fungi, acids, and organic solvents. And more eloquently for their simple spread-on application, and perfect cures at reduced temperatures. *Anyone* can use PENACOLITE adhesives.

For information regarding application of PENACOLITE adhesives to your process write Pennsylvania Coal Products Company. Details covering intended uses, materials to be treated, and production methods will enable us to suggest the PENACOLITE best suited for your purpose.

Photograph of Model "20" Economy Cruiser, courtesy of the Doane Marine Works, Stamford, Connecticut.

Write **Department A-4**

PENNSYLVANIA COAL PRODUCTS COMPANY

PETROLIA, PENNSYLVANIA

Distributed in Canada by **CANADIAN INDUSTRIES LIMITED**, Montreal, Canada

Photos here and on first page of article were taken, by ***plastics*** staff photographer, of injection-molded articles in the Capt. Nalle-SPI collection. Shown are bottles for gas decontamination liquid (left); canteen, thermos bottle (right)

German Products Not Made in U.S.

ct	Estimated 1943 Production (lb)	Uses and Comments
ethers	10,000,000	Adhesives—water and oil soluble thickeners, etc.
nates	Under 500,000	Extremely versatile plastics base material
nated polyvinyl oride	10,000,000	Chemical and fungus resistant fibers
thylene	200,000	Cable insulation

t 2500 oz or an average of about 1.7 oz per machine. ing the war the industry employed 6300 people, of ch two-thirds were women.

lastics materials for this industry during the war were icated by somewhat the same mechanism and in the same eral fashion as in the United States. The German or- ization similar to the U. S. War Production Board alling plastics was administered by experienced men n the fabrication industry and was divided into three n sections: Celluloid, Injection Molding Compounds, Compression Molding Compounds. The system was to have operated quite smoothly. The average monthly duct allocation available in 1944 was divided about as ows for injection molding: polystyrene, 1,000,000 lb; l polyvinyl chloride, 110,000 lb; soft polyvinyl chloride, 000 lb; cellulosics, 25,000 lb; and polyamides, 6,000 lb, an approximate total of 1,250,000 lb.

wo main types of injection machines made up over 90% he units operated in Germany. They were the Isoma the Eckert Ziegler machines. They are of the same eral design, but the Braun Company (Isoma) held pat- s on fully automatic operation so the Eckert Ziegler chines were manufactured to operate largely as semi- omatic units. The business was shared about equally the two companies. Isoma machines were made largely 30 and 50 gm (1+ and 2 oz) capacity with a smaller nber being produced having a capacity of 120 gm (4.3 . The Eckert Ziegler units were largely 50 gm (2 oz). wever, 120 gm units (4.3 oz) accounted for a larger tion of their more recent production. The latest develop- nt was a 400 gm (14 oz) horizontal machine, of which r or five had been made. The smaller machines were usually air-operated, and in the larger plant a centralized air accumulator system was used.

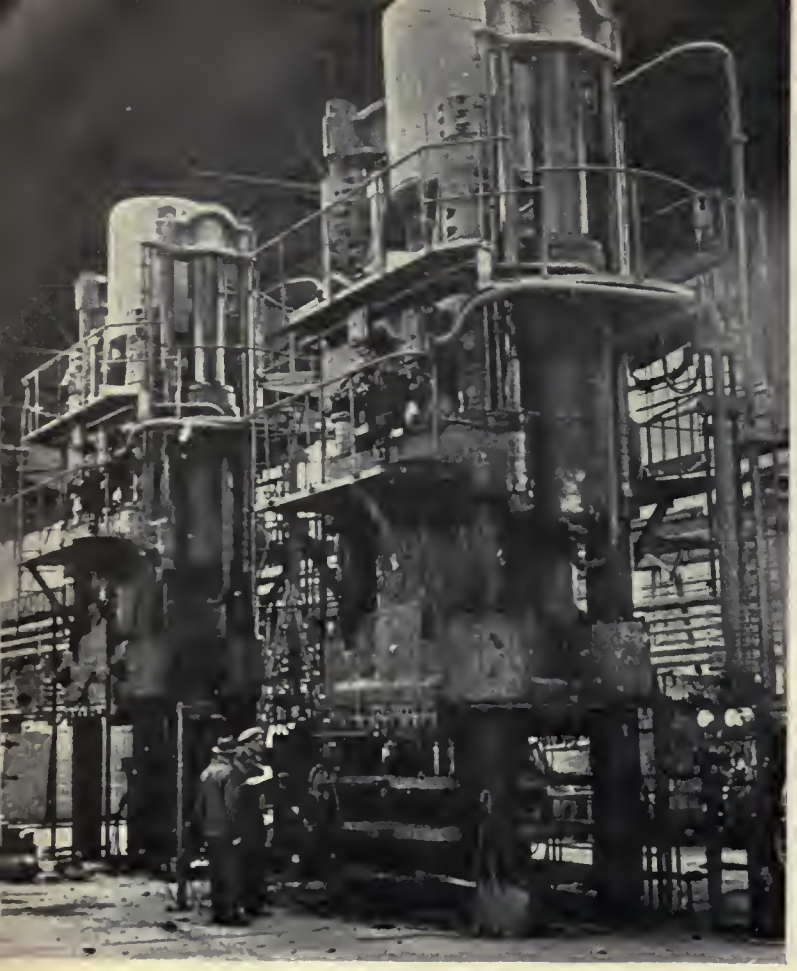
While the large majority of fabricators fell in the class of having less than five injection machines, eight companies had 21 or more apiece, and one company had 70.

The war-time products fabricated by injection were largely confined to small items because of the limited capacity of the average machine. These products included several types of mortar fuses from polystyrene; polystyrene and acetate combs; polystyrene tube caps; polyvinyl chloride anti-gas decontamination bottles; buttons of polystyrene, acetate, and polyamide; polystyrene and polyvinyl chloride electrical parts; radio parts—polystyrene with magnetic filler; medical items, cups, etc. of polystyrene; dental parts of polystyrene; aircraft connectors of methyl methacrylate; polystyrene gas mask parts; zippers of polyamide, polystyrene, and acetate; bomb fuse parts of polystyrene; fountain pen parts of polystyrene; airplane and ship models of polystyrene; and flashlight parts of polyamides.

Plastics slide fasteners were produced in only one tooth size, about six colors, and three lengths. They were made

United States and German Production

Product	1943 (Approximate Pounds)	Uses and Comments
Vinyl chloride and copolymers	G. 80,000,000	Sheet, large pipe, fittings, injection moldings (G); flexible sheet, coatings, moldings, extrusions (U.S.)
	U.S. 83,000,000	
Polystyrene	G. 16,400,000	Injection moldings, thin sheet
	U.S. 4,000,000	" " " "
Acrylates	G. 61,000,000	Moldings and sheets
	U.S. 70,000,000	" " " (12,000,000) (32,000,000)
Cellulose derivatives (not water soluble —not including nitra-cellulose)	G. 7,000,000	Other German cellulose production used largely for paper for propaganda and for textiles
	U.S. 85,000,000	
Cellulose derivatives (water soluble)	G. 15,000,000	Large production to extend soaps
	U.S. 2-3,000,000	Mainly sizings and foods
Polyamides	G. 16,000,000	Largely for textiles and films
	U.S. 20,000,000	" " " " "
Phenolic resins	G. 70,000,000	About same uses as in U. S.
	U.S. 144,000,000	
Urea resins	G. 75,000,000	Extensive use in adhesives
	U.S. 54,000,000	Moldings and adhesives



These two 5,000-ton compression molding presses, in the Dynamit plant at Troisdorf, may be the world's largest

by injection molding cellulose acetate, polystyrene, or polyamide teeth directly on the bead of the cloth tape as the insert. The complete fastener length with both sets of teeth were injected from the same runner, very small gates being used. Little finishing was required on these teeth after the gates were broken off. The standard Swiss-type fastener injection machine was used. The six machines of

This monstrous single-cavity, thirty-ton die was used for the compression molding of submarine battery cases

this plant were cleverly mounted at about 30° with t horizontal, allowing easy table operation for efficiency.

From the above summary it becomes quite apparent th the country credited for the introduction of injection mol ing has not kept pace in this field with the United Stat The average German injection molding machine of 1.7 capacity is far below the U. S. average of approximate 6 oz. The operating personnel used per ounce of capaci of 2.5 persons indicates that, while most machines we capable of fully automatic operation, the die design a other factors were such that they were nearly alwa manually operated. . By way of comparison, the U. S. o erating labor required per ounce of capacity has been es mated at well under one person per ounce.

Material shortages and rapid developments in other fiel have had their influence in forcing injection molding Germany into a less prominent position. While some of t war-time applications are unique, it is obvious that portion of the plastics industry did not play as important war-time role as in the United States.

German technological developments in injection machin have not advanced much in the past few years. The tre toward larger, single-nozzle machines has not been pr nounced. The four or five 14 oz machines in operation we still considered experimental. As far as could be asce tained, only one experimental multi-nozzle had been mac Of rather crude design, it did not operate satisfactorily.

Most German injection machines were electrically heate but they did not embody any outstanding features, exce for preheating as used in the 14 oz Eckert Ziegler uni In this machine, electrically-heated air was blown slow through the feed channel and feed box in a countercurre fashion to preheat and dry the material in the hopper. was said to improve drying and to decrease the heatin time in the cylinder.

Injection dies for German machines are, of course, ve small by American standards. They are usually cylindric and designed so that they can largely be made by lathe a drill press operation. The significant developments in th field were toward devices which would clean the spru from the pieces at the time of removal from the mold. Th can be accomplished by a separate plate with quick actu tion which moves in the piston direction and shears t flash and gates, or a side moving cutter which shears t sprues. Many of these mold design features are discuss in an excellent small book entitled *Der Spritzguss Therm plastischer Kunstoffe* by Dr. Laies. A majority of D Laies' molds are made so that a single handle retracts great many movable cores designed to give recesses in th piece. Some involved as many as 50 plungers operat in various directions. The design is complicated, but t operation is simple.

Compression Molding

Compression molding of plastics materials accounted f a large portion of the fabrication industry in Germany. Th is particularly true of transfer molding of thermoplasti included in this category.

The materials used for compression molding were stan ard—phenolics, ureas, some melamines—all in a wide ran of fillers and flows. Early in the war the quality of the materials was average. Later, shortages of impact fille and of base resins resulted in inferior formulations. Ev important military applications suffered in this regard.

It was interesting to note the extent to which transf molding of thermoplastics was used to produce larger mol ings than were possible with their small size injection m chines. Polyvinyl chloride was chiefly used, but son applications for polystyrene and polyamide were also foun The moldings thus produced weighed from eight ounces

HEADLINES and HEADLINERS

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Paint Progress
End of War to Release New Raw Materials; Resins to Play Big Role
Protective Coatings Made Entirely From Domestic Products Now Possible
Makers Eye Wider Markets

A. B. NIXON, *Vice President,* Hercules Powder Company

OUR current oim is to meet the demonds of the processing industries for Hercules products—pre-wor d wor-born—which ore necessary in the resumption of ace-time economy. In this connection, The Wall Street Journol is proving of inestimoble volue to many executives in this compony. My thonks to the Journal's editors for their excellent reporting of business news so important to the chemicol and allied industries."

THE WALL STREET JOURNAL

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Trial phenolic moldings include photographic developing tank, half of aircraft wheel assembly, and large tubing

nearly two pounds. They included storage batteries with complicated lead inserts, and polyvinyl chloride *(Vinidur)* pipe fittings, valves, etc.

Only a limited number of compression molding plants were visited. One that seemed to embody all the features of the industry was the Dynamit (Venditor) plant at Troisdorf, mentioned previously as the IG controlled selling and fabricating branch of this big cartel..

The large molding capacity was divided between two plants, an older one with smaller equipment (No.1) and a later and separate one (No. 2) with equipment ranging up to two 5000-ton presses. Damage to these plants was extensive.

Plant No. 1 had 150 compression molding presses divided as follows: 1—600 ton, 2—250 ton, 4—390 ton, 2—125 ton, 35—45 ton, and approximately 80—under 40 ton.

These presses operated from central water accumulator systems, one operating at 200 atmospheres (3000 psi) and a second at 250 atmospheres (3750 psi) with a 4 atmosphere (60 psi) press closing system. All production presses were heated from two (190° C or 374° F) hot water, high-pressure lines. The exit side of the press jackets discharged into 160° C (320° F) return lines. Preheating ovens located beside each press were heated by this exit 160° hot water. The actual oven temperature was 130°-140° C.

Molding temperatures for phenolics averaged close to the available 190° C (374° F) with the oven preheating at 130° C, while for the ureas 175° C without preheating was said to be standard.

The high-pressure, hot water heating method was said to be very satisfactory for several reasons: (1) the Germans are familiar with high-pressure operations; (2) high specific heat of hot water is desirable; (3) temperature is easily controlled by pressure; (4) any leaks result in less dangerous low temperature steam due to heat requirements for vaporization; and (5) it is less expensive than other methods.

Interesting presses in this plant included several of a moving cylinder type (rather than of a moving piston). In these units the piston was attached to the press head, and four tie rods extended from the head to the press base. The cylinder casting rode on eight bearings, four on top and four on the bottom, these providing excellent alignment.

Two of the special presses in this plant had external-hinged, locking clamps, heavily built, to clamp the mold shut while pressure was moving the plastics from the transfer pot to the molding cavity. These presses were used for molding polyvinyl chloride.

Another modified transfer type made use of double pistons—one vertical for clamping and one horizontal for injecting. Here a three-element die was commonly used. Typical products were large thermosetting spools and bobbins.

Plant No. 2 was the larger, more modern, plant and was used for the production of heavy, intricate moldings. The activities were partially based upon the molding of phenolic impregnated paper made right in this plant. Here kraft woodpulp sheets were beaten up in hollanders with phenolic resin powder, cured to a water-insoluble stage. (This resin was made in another building nearby.) Twenty to forty percent resin was added, and the slurry was run through a board machine producing sheet about six feet wide. The board was cut and stacked in a conditioning room. These sheets were then tailored, fitted, and preformed in one of the available presses. Final molding in a larger high-pressure press followed. The capacity of this paper plant was over 200,000 lb per month. German technicians pointed out that recent cost figures indicated that sheet made on this machine in their plant could not compete with phenolic-coated kraft paper purchased in the open German market.

The equipment of this plant, other than the paper machines mentioned above, included a dozen modern presses, dies and die storage, accumulators, and heating plant. The two largest plastics presses in Europe—possibly in the world—were located in this plant. They were of 5000 ton capacity, moving cylinder type, with automatic temperature and cycle controllers. They could be used as platen presses or for large moldings. A 1500 ton press with long, narrow platens was provided. Nine other compression presses ranging from 100—1500 tons were available. A tube rolling machine based on three 120° spaced pressure rolls bearing on the rolling mandrel was located in this plant.

In this plant, as in Plant No. 1, the die heating system was 190° C high-pressure water. Die pressure was applied by a central water accumulator system operating at 325 atmospheres (4750 psi) using air bottle reservoirs.

An important military molding made in a 5000 ton press and based on the preformed paper was a battery box for submarines. It was end opening, about 40″ high by 20″ by 15″ with some wall sections ½″ thick. The die was around four feet high, five feet wide, and seven feet long weighing about 30 tons. Phenolic impregnated sheets, cut to size were scored and folded to fit the preform mold. These preforms were pressed slightly warm in 1200 ton presses. The assembly for preforming consisted of two scarf-edged, U shaped channels for walls and a pan-shaped bottom. The box was molded on its side in a three-piece mold with the die parting line passing through the diagonally opposite edges. A heavy floating core was used.

Other interesting moldings produced in these plants were thick phenolic bearings for rolling mills and ships; experimental all-phenolic skis, airplane wheels—some 20″ in diameter; photographic developing tanks over 2′ square and 6″ deep; heavy-walled tubes 20″ in diameter; cloth-filled (later changed to inferior paper filling) phenolic binocular cases; artillery fuse boxes; field telephones and boxes; connector blocks; battery elements; compass housings; polyvinyl chloride *(Vinidur)* pipe fittings, filter plates and valves; and decontamination bottle covers.

This plant also produced *Lignofol*, a beechwood laminated with *Tego* (phenolic) paper for the manufacture of aircraft propellers and cheap molds for rubber bag molding. Maximum production was 4,000,000 lb per year.

In compression molding, the developments indicated the Germans to be well advanced. Products during the war were not of the best quality because of shortage of good impact fillers and the necessity for stretching the limited resin supply to the point where molding composition resin contents were dangerously low. (TO BE CONTINUED)

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SPI Conference and the National Plastics Exposition

Plans for exhibition in New York are comprehensive in scope, with entire industry looking forward to event

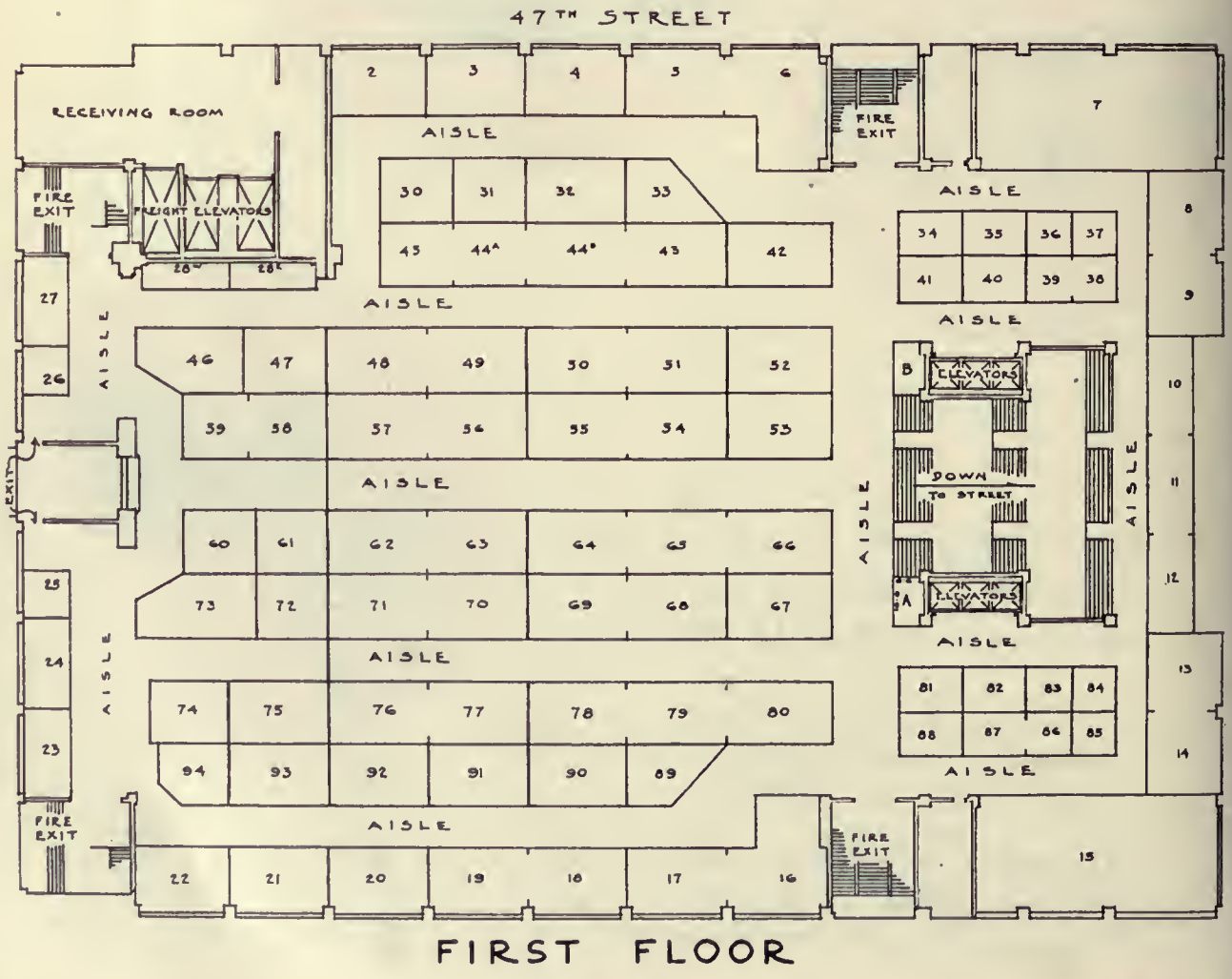
NOT everybody in New York at the moment is talking of the first National Plastics Exposition to be held at the Grand Central Palace, but they certainly will be from April 22 to 27, when the event for which so many people are making exciting preparations takes place. Something like 200 companies—materials producers, processing equipment manufacturers, molders and fabricators, and makers of plastics products—will have display and demonstration booths at the Exposition. Since the Society of the Plastics Industry, which sponsors the show, is holding its conference at the same time, anybody who has any interest in the plastics industry, directly or indirectly, is expected to attend. As for the general public, whose major concern, aside from pure curiosity, is with consumer products, attendance is likely to be very heavy.

However, in order to permit thorough study of the exhibits by representatives from industry, the general public will be admitted on the last three days only. The SPI has accordingly appealed to manufacturers who use plastics materials to time their visits to the Exposition during its first three days, April 22 to 24, when technical experts of the participating companies will be in a better position to give them individual attention.

"For the manufacturer who recognizes an opportunity to add new products to his line, to impart new quality and sales appeal to existing products," said Ronald Kinnear, Chairman of the SPI Exposition Committee, "the National Plastics Exposition will present an unparalleled opportunity to acquire a thorough and comprehensive knowledge of what has to many been a complex—if alluring—possibility.

"Scores of experts, leaders in every phase of plastics, will

(*Continued on page* 90)



GUIDE TO EXHIBITORS' BOOTHS

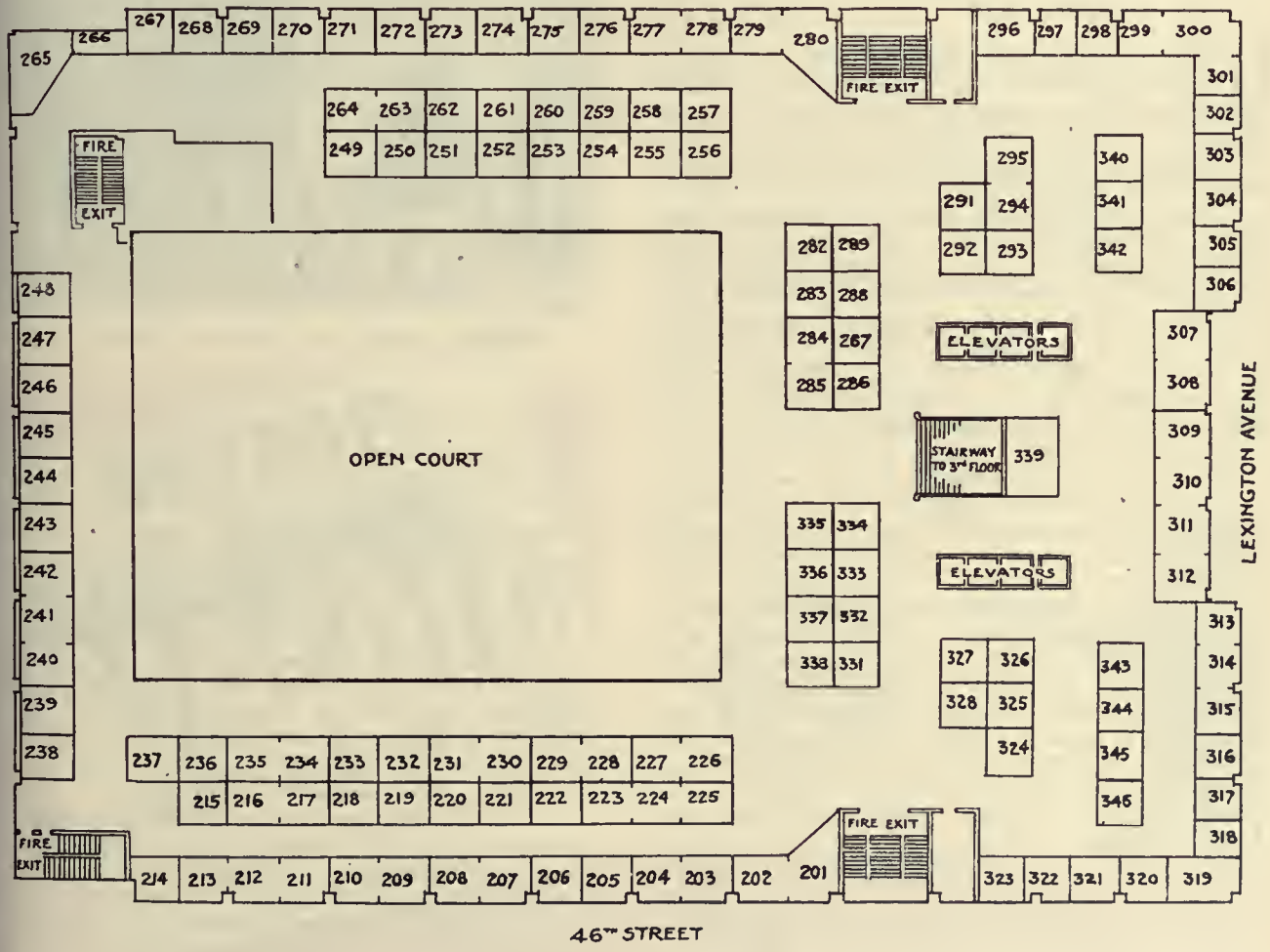
Booth numbers omitted had not been assigned at time this issue went to press.

BOOTH NO.	EXHIBITOR
6	Prolon Plastics (Div. Prophylactic Brush Co.)
	Goodyear Tire & Rubber Co.
	Reed-Prentice Corp.
	Shaw Insulator Co.
9	E. I. du Pont de Nemours & Co.
0-12	Respra, Inc.
3-14	Durez Plastics & Chemicals, Inc.
5	Hercules Powder Company
5-17	U. S. Rubber Company
3-19	Tennessee Eastman Corp.
0	Catalin Corp.
1	Lester-Phoenix, Inc.
2	Columbia Protektosite Co., Inc.
	Elmes Engineering Works — American Steel Foundries
3	W. L. Stensgaard & Assoc., Inc.
4	Leominster Tool Soles Co.
5	Chemaco Corp.
6	American Plastics Corp.
7	Denison Engineering Co.
8W	Detroit Mold Engineering Co.
0	Grigoleit Co.
1	Federal Telephone & Radio Corporation
2	Du Page Plastics Co.
3	Durite Plastics, Inc.
4	Elmer E. Mills Corp.
5	Plastics Industries Tech. Inst.
6	Yardley Plastics Co.
7	M. M. Gottlieb Associates, Inc.
8-39	Interlake Chemical Corp.
0	Plastimold, Inc.
1	Airtronics Mfg. Co.
2	Tech-Art Plastics Co.
3-44B	General Electric Co.
4A-45	National Plastic Products Co.
6	B. F. Goodrich Chem. Co.
7	Detroit Macoid Corp.
8-49	Hydraulic Press Mfg.
0-51	Watson-Stillman Co.
2	American Machinist-Product Engineering

BOOTH NO.	EXHIBITOR
53	Ideal Plastics Corp.
54-55	Celanese Plastics Carp.
56-57	Plaskon Division
58-59	Continental Can Co.
60	Creative Plastics Corp.
61	Herbert J. Herlbert
62-63	Dow Chemical Co.
64-66	Rahm & Haas Co.
67	Bachmann Bros. Inc.
68-69	Bakelite Corp.
70-71	American Cyanamid Co.
72	Mack Molding Co.
73	Universal Plastics Corp.
74	R. D. Werner Co., Inc.
75	Defiance Machine Works
76-77	Madern Plastics
78-80	Monsonto Chemical Co.
81	Irvington Varnish & Insulator Co.
82	National Vulcanized Fibre Co.
83	E. B. Kingman Co.
84	Omni Products Corp.
85	Croasdale & DeAngelis Inc.
86-87	RCA Manufacturing Co.
88	Keyes Fibre Co.
89	Plastic Manufacturers, Inc.
90	American Insulator Corp.
91	F. J. Stokes Machine Co.
92	Girdler Corp., Thermex Div.
93	Erie Resistor Corp.
94	Eclipse Maulded Products Co.
A	Cleworth Publishing Co., Inc.
B	Taylor Fibre Co.
201-202	Owens-Corning Fiberglas Carp.
203-204	Vickers Inc.
205	Generol Hard Chrome Co.
206	J. M. Gordon Labaratories
207-208	Gemloid Corp.
209-210	Plastic Engineering, Inc.
211-213	Sav-Way Industries
215	Preco, Inc.
216-217	Arnold Brilhart, Ltd.

BOOTH NO.	EXHIBITOR
218	Unassigned
222	Cleveland Cantainer Co.
223-225	Reinhold Publishing Co.
226-227	Boonton Molding Co.
228-229	New York Air Brake Co.
230-231	Plastic Film Corp.
232	Specialty Insulation Mfg. Co.
233	Metaplast Company
234-235	Baldwin Locomotive Works
236	Scheuer Manufocturing Co.
237	Schwortz Chemical Co.
239	Eriez Manufacturing Co.
240-242	Notionol Tool & Mfg. Co.
249	Superior Plastic Company
251	Lee-Bert, Inc.
254	Machine Design
255	Livingston Plastics Carp.
256	Watertown Manufacturing Co.
258	Ziff-Davis Publishing Co.
259	Radio Receptar Co., Inc.
261	Nicholl Hard Chrame Service
263-264	Columbus Plastic Products, Inc.
265	Illinois Tool Works
269	Hunton Plastics Co.
274	Miskello Infra-Red Co.
275	Society of Plastics Engineers, Inc.
276	Van Dorn Iron Works
277-278	Nixon Nitration Works
279-280	Celluplastic Corp.
282	Amos Molded Plastics Div.
283	Steiner Mfg. Co.
284-285	Victor Metal Products Corp.
286	S. S. White Dental Mfg. Co.
287	Cruver Mfg. Co.
288	Waterbury Companies, Inc.
289	Borkland Laboratories
291	Santay Corp.
292	Reichhold Chemicals, Inc.

BOOTH NO.	EXHIBITOR
293	Northern Industrial Chemical Company
294-295	Do All Eastern Co., Inc.
296	Surprenant Electrical Insulation Company
297	Popular Plastic Products
298	Unassigned
299-301	B. F. Goodrich Company
302	Unassigned
303	Unassigned
304	Unassigned
305	Kenneweg Soles & Engineering Company
306	Unassigned
307-308	Synthane Corp.
309-312	Westinghouse Electric Corp.
313-315	Industrial Synthetics Corp.
316	American Technical Society
319	U. S. Naval Ordnonce Laboratories
321	Midland Die & Engraving Co.
322	Christian E. Burckel & Associates
323	Taylor Manufacturing Co.
324	Plasteck Manufacturing Co.
325	Nu-Dell Manufacturing Co.
326	Geo. V. Clark Co., Inc.
327	Precision Specialties
328	Acadia Synthetic Products
331	Tri-United Plastics Corp.
332	Chicago Molded Products Corp.
333	Roger Seligmon
335	Anchar Plastics Co.
336	Vorgish & Company
337	Emeloid Co., Inc.
338	Atlantic Plastics, Inc.
339	Society of the Plastics Industry
340	Raytheon Manufacturing Co.
342	Plastics Reporter
343	W. T. LaRose & Associates
346	Northwest Syndicate, Inc.



SECOND FLOOR

Cementing Phenolic Laminates

New development in adhesives makes possible assemblies of laminated phenolics said to be as strong as the original material being bonded

These unusual and attractive acrylic-laminated phenolic combinations were cemented with a "Furane" adhesive

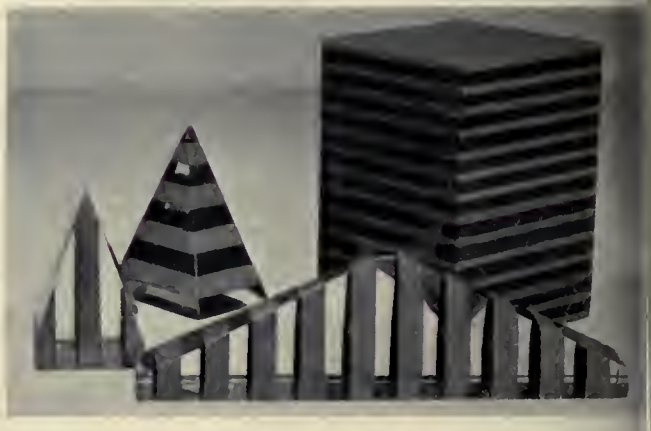
By John Delmonte

Technical Director, Plastics Industries Technical Institute

LAMINATED phenolic plastics have been introduced to numerous assemblies where high strength, good mechanical durability, and good dieleetric properties are paramount. As a basic material of construction, they have few equals because of their superior electrical and mechanieal characteristics. Since they are formed largely with the aid of thermosetting phenolic resins, the assembly of components of laminated phenolics is not readily accomplished by the solvent cementing usually employed with fabricated thermoplastics. In consequence, parts are generally assembled with meehanieal screw, rivet, spring, and dove-tailed devices. For the most part, these methods of attaehment are aeeeptable, though redesigning of laminated phenolic parts is generally necessary to make some provision for the inclusion of a metal attachment member.

The general problem of assembling, designing, and fabricating parts of laminated phenolic materials faces revision in the light of reeent developments in furane resin adhesives which make possible unusually strong and reliable cemented assemblies. These cemented assemblies are in the main fully as strong as the original materials being bonded, as a complete mechanieal as well as chemical bond has been realized.

A striking example of this principle, illustrated in Fig. 1, is the assembly of a spool from canvas-base laminated phenolie. Before the manufacturer adopted a eemented assembly, he had to machine wastefully the complete spool from a large bloek of laminate, or else machine and turn threads upon a smaller diameter rod for assembly to the end flanges. Both of these were reliable assemblies, of course, exeept for the ereep which presumably would occur in the threaded attachment. However, the eost was much redueed when it became possible to assemble sheet stock and the rod about a mandrel, with the aid of furane resin cement. The machining operations were eliminated, making it possible to employ members whieh had been blanked out by punching dies to the final dimensions. Another important advantage is



Composite laminates offer designers a "field holiday"

that the end flanges are no longer limited to circular shape which must be turned, and that any geometrical shape o type of perforation which can be punched from sheet stoc would be safe to specify in the design. This is of impor tance particularly to coil forms, where the end flanges mus also make provisions for the attachment of wires, as on suitable insulating strip.

In the development of the furane adhesives, which posses a high specificity towards phenolics, samples of Grade "C laminated phenolics were proeured from the major pro ducers of this material throughout the United States. Th results obtained, which are released generally here for th first time, indicate for the most part reasonable uniformit among Grade "C" laminated phenolics, as well as muc basie data on the fundamentals of adhesion.

In the first place, we have been prone to consider tha eementing is best aecomplished by mechanieally roughenin the surfaces to be joined. The improved adhesion has bee explained in part by the greater mechanical interloekin due to the roughened surfaces, though other persons prefe the explanation that the roughening exposed a greater sur face area for a given glue spread, and henee insured

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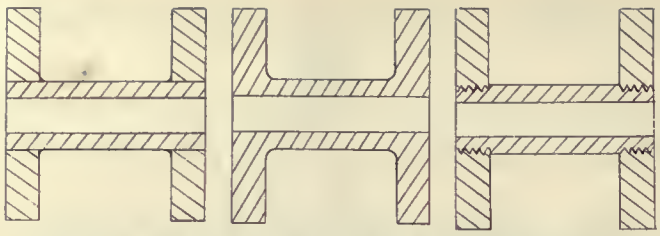


Fig. 1. Three ways to make a spool: left, cementing; center, turning from solid block; and machining from rod and sheet stock. Cementing is most economical way

greater opportunity for chemieal bonding because of the polar characteristics of the adhesive and the surface being bonded. In both instances, the phenomena involved are closely related to the surface chemistry of the materials being bonded. However, in the application of furane resin adhesive to laminated phenolic, best bonding occurs largely with a smoothly polished surface, without the benefit of mechanical roughening. This should definitely indicate a true chemical bond, which is understandable in the light of the partially polymerized fractions of the laminated phenolics and the aldehydic components of the furane resin adhesive.

The table below shows the results of tests on twelve makes of canvas base laminated phenolic. Key symbols indicate laminates of different manufacturers. The failures in the laminated phenolics may be grouped into three varieties: (1) those taking place in the glue film; (2) those taking place in the skin of the phenolie sheet, generally with small areas or portions of the fabric visibily attached to the glue line; and (3) those occurring completely in the phenolic. This last type, of course, is the optimum insofar as adhesive strength is concerned.

In examining the above results it must be borne in mind that the usual urea or phenolic type adhesive will seldom exhibit shear strengths above 500 psi upon a smooth surface, or above 2000 psi upon a rough surface. All tests were performed by the compression shear method, dimensions and form of the test specimen being given in Fig. 2. Ends were squared, and a compression load was applied to the center protruding portion at a rate of 0.2″ per minute crosshead travel speed on the testing machine.

In this connection, the interpretation which should be given to shear strength is open to question, because such results are often dependent upon the geometry of the test specimens. In all of the above tests an overlap of one inch was employed. Judging from results in testing metals, one ventures an opinion that even higher unit shear strengths would have been observed if the overlap had been less. However, another variable was explored to a limited extent —the thickness of the center layer of the three layer thick assembly of laminated phenolics.

Shear strengths as high as 6000 psi were obtained as the thickness was increased. This was observed upon test specimens identical in the proportions and the dimensions of their glue lines. Results are plotted for this unexpected result in Fig. 3. On the other hand, by increasing the thickness of the supporting shoulders on either side of the center layer (refer to Fig. 2), the apparent shear strength did not change appreciably. One would expect, consequently, that the values of shear strength in several cases in the preceding table are reflections of compression failure in the phenolic. Inasmuch as the shear area of the test specimen was 2 sq in, and the cross-sectional area of the center protruding portion ¼ sq in, the load to cause failure, averaging about 7000-8000 lb, created a compressive stress in the laminate near 30,000 psi, which is close to their ultimate compression failure. Shown in mathematical form:

$$\frac{\text{Load to Cause Failure}}{\text{Area Under Shear}} = \text{Apparent Shear Strength (psi)}$$

The problem is further complicated by the load distribution to the shoulders as stress is developed, and hence the assumed index of *apparent* shear strength appears to be acceptable, provided that the dimensions of the specimens are stated. The limit of shear strength for the canvas base laminated phenolie does appear to lie as high as 6000 psi when tested *parallel* to the planes of the laminations.

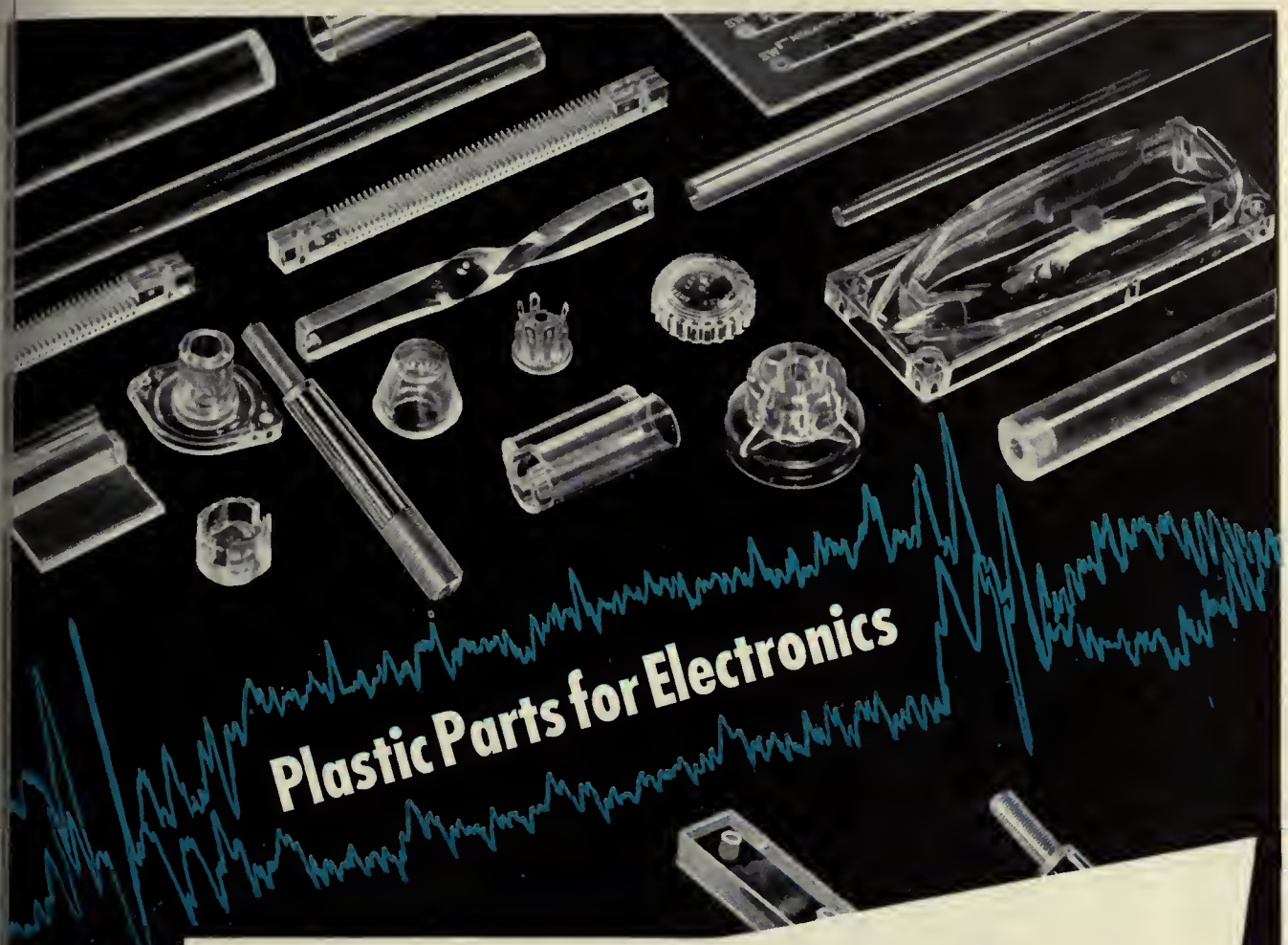
In tests upon the same stock as those used for cementing tests, ASTM D-732 shear tests were performed, and average results computed. These tests were, however, completed *perpendicular* to the laminations, which would of course yield higher results than tests parallel to the laminations. Good uniformity of results among the various grades of laminated phenolics from twelve different sources is indicated. (See data in table on the next page.) In the testing procedure, holes of approximately 7/16″ diameter were drilled in the sheet stock. The samples, measuring approximately 2″ by 2″, were assembled about the punch, which was then positioned in the Johnson shear tool jig. The diameter of the eylinder sheared from the sheet stock measured 1.0″. Acknowledgement for performing the ASTM tests is made to L. Mohr and R. Herwitz of Plastics Institute in Los Angeles.

Further acetone extraction tests were run in accordance with ASTM D-494 to try to determine whether or not the values obtained from extraction would give some clue as to the probable physical behavior of the materials. No

Cementing Tests of Grade C Laminated Phenolics, ¼ Inch Thick

Key No.	Average Shear Strength Unsanded Surface (As Furnished) (psi)	Type of Failure	Average Shear Strength Sanded Surface (psi)	Type af Failure
A	2835	Completely in phenolic	2850	Completely in phenalic
B	2650	Surface skin of phenolic	2955	Surface skin of phenolic
C	2765	Surface skin of phenolic	3015	Surface skin af phenolic
D	3340	Completely in phenolic	3090	Completely in phenalic
E	3630	Completely in phenolic	2995	Completely in phenalic
F	3315	Completely in phenolic	2735	Surface skin of phenalic
G	2055	Glue failure	3540	Surface skin of phenolic
H	4100	Completely in phenolic	3900	Completely in phenolic
I	4005	Partial failure through phenolic	2515	Surface skin af phenalic
J	3035	Surface skin of phenolic	2700	Surface skin of phenolic
K	2775	Partial failure in skin	1800	Glue failure
L	810	Glue failure	2615	Surface skin of phenalic

NOTE: All assemblies were effected with Furane Resin X-2 Adhesive under the following conditions; (1) Pot life of adhesive—60 to 90 minutes; (2) Open assembly time—5 to 10 minutes; (3) Catalyst—5% of Z-2; (4) pH of glue line—2.5 to 2.8; (5) Cure conditions—4 hours at 140° F and condition one week at room temperature; and (6) Clamping pressure—approximately 5 psi.



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correlation between the physical properties and the acetone extraction tests was readily apparent.

In comparing results of shear test parallel to laminations, as obtained from the cementing tests, with the data obtained from Johnson shear tool perpendicular to the laminations, the writer feels that the former test is even more significant. The parts or laminations still could be bonded together quite ineffectually, and this would not be apparent in physical tests perpendicular to the laminations.

A few comments may be made regarding the application of the data from the cementing tests to design considerations involving relatively thin laminated phenolic paper or canvas base stocks. Still another consideration of high stress concentration may cause the cemented specimens to fail at extremely low loads. This is apparent, for example, when attempting to drive a wedge between the cemented surfaces. If the laminated phenolic sheet is thin enough to bend appreciably, a very high stress concentration will develop in the immediate vicinity of the wedge, involving tensile as well as shear stresses, and the apparent failure at very low loads. This may he apparent even though substantially all of the phenolic skin may be stripped from the surface of the sheet in the process. The action may be likened to a direct pull upon a flexible gummed tape, which would cause the tape to fail. However, if the tape is folded back upon itself, the rolling shear which is developed can result in

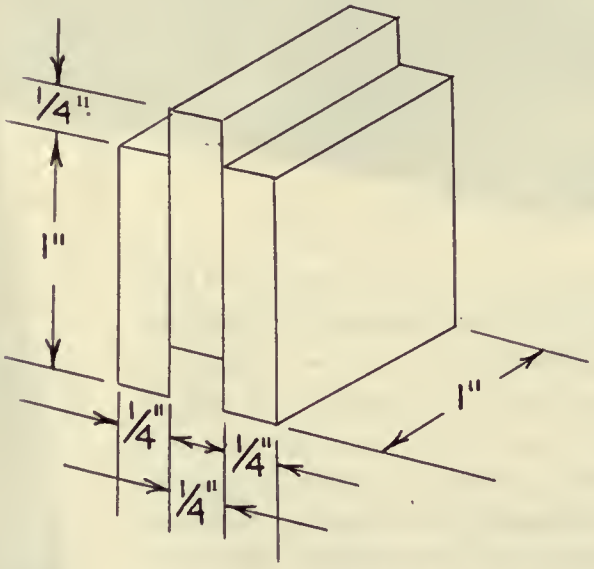

Fig. 2. Dimensions and form for shear test specimen

separation of the tape from the surface to which it has been applied, without much difficulty.

There are, however, a few design remedies to be recommended in the bonding of laminated sheet stock of relatively thin gage (say, ⅛" thickness and under). These procedures will permit the attainment of the full design value of the adhesive:

(1) A few tack rivets at the edge would be desirable to prevent the sheets from starting to unpeel because of some unusual mechanical action. This procedure was followed in the cementing of a laminated phenolic ammunition box with furane resins, which after many severe cycles of tests finally failed in the phenolic rather than in the glue line.

(2) An additional reinforcing strip at the edges to increase the overall thickness at the edge would prevent any incipient fold-back, and the high shear strengths of the glue will be realized.

(3) Considerable improvement has been observed by the

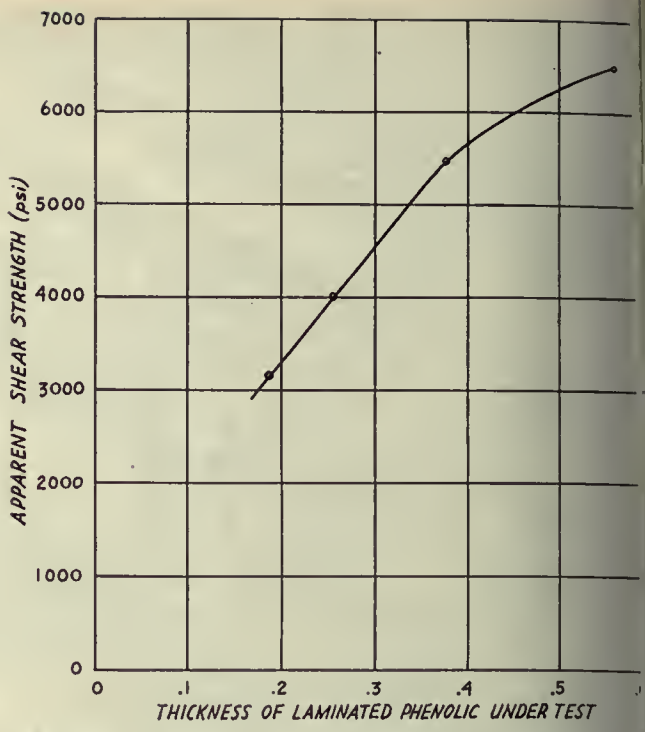

Fig. 3. Results of varying thickness of center panel in unsanded Grade C phenolic laminate glued by "Furane X-2"

writer when the edges are scalloped or finished in a toothed design as would be obtained with pinking shears. The advantages in this instance lie in a rather fortunate combination of circumstances, most important of which is the accumulation of adhesive immediately outside the edge of the sheet stock being joined. This creates a fillet and contributes to maximum strength. It has been determined mathematically that for relatively stiff adhesives, such as the furanes, the greatest stress concentration over the glue is placed in close proximity to the edge of the assembly. On the other hand, it is also recognized that when the properties of the adhesive approximate those of the materials being bonded, the optimum in assembly conditions is realized.

So far most of the discussion has been applied to the canvas-base laminated phenolic, though a few notes may be made on other materials with the furane resin adhesives.

Material failure occurred in polyester resin laminates at 3000-3500 psi; in Grade XX paper-based phenolics, 1500-2000 psi; and in *Masonite* die stock, 1000 psi.

A high shear strength parallel to the laminations is apparently characteristic of the high pressure canvas-base laminated phenolics—a strength much better than for paper base.

Most of the discussions so far have focused upon the technicalities of cementing laminated phenolics. Let us now examine a few of the new applications that these adhesives make possible. The effect may be visualized by

(*Continued on page 92*)

Shear Testing with Type "C" Laminates
(ASTM D-732)

Type	Average Shear Strength (psi)	Type	Average Shear Strength (psi)
A	13194	G	13751
B	14329	H	13400
C	15231	I	13094
D	13932	J	12577
E	13734	K	13210
F	15269	L	12742

These are but a few of the items for which our plastic coated fabrics and papers will be used after the war.

There are many other applications, of course, some of which are already familiar to our research staff—many more have not yet come to our attention.

Check *your* post war plans. Do plastic coated fabrics and papers show up anywhere in the picture?

An early contact with a reliable source of supply will give you the advantage of an early start with many of the experimental hurdles behind you.

We have the plant facilities and the experience to help you build a "quality line" right from the start. Our craftsmen were among the first to master the new and difficult technique of applying the new vinyl resins to fabrics and papers. We are one of the largest suppliers of these fabrics to our armed forces.

You name it—chances are we can coat it. Your inquiry will be held in strict confidence and accorded every possible consideration.

Joanna
Coated Fabrics

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Plastic Fabrics Division: VINYL RESIN, PYROXYLIN AND OTHER PLASTIC COATINGS • PROOFED FABRICS AND PAPERS • SIMULATED LEATHERS

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Window Shade Division: WINDOW SHADE CLOTH, ROLLERS AND ACCESSORIES • CLOTH AND PAPER WINDOW SHADES

EXPORT OFFICE: 40 WORTH ST., NEW YORK 13, NEW YORK

Radio-phonograph cabinet, covered in Meyercord Co.'s "Sans-Arb Mocassar Ebony," has hinged cover and front of clear "Plexiglas." Industrial designer Harry Preble, Jr., developed the instrument

Plastics at Work

Laminated and formed under low pressure in one operation, this binocular case developed for use in the U. S. Fleet is of vinyl and phenolic-impregnated "Fiberglas" fabric

The frame and base of this double shaving mirror are molded of ivory or white "Tenite" by Nosco Plastics Division, National Organ Supply Co., for Consolite Corp. Mirror is adjustable to a variety of angles

Window ventilator made of Celanese Plastics Corp.'s "Vimlite" translucent plastics covered wiremesh is virtually stormproof yet admits maximum quantities of filtered air and daylight

A dagger composed of corn brass and Plexiglas won first prize for inventive use of materials in a contest spansored by the 2nd Service Command, while first award for originality of design was won with an entry, carved from clear "Lucite," representing a shark emerging from the waves. Photographs were made at the Metropolitan Museum of Art, N. Y., where entries were on view in a recent exhibit of Army Handicrafts

Schick Shaver
(*Continued from page* 40)

means. The outer flash is first removed on an endless belt sander, and the case is then polished on 12-inch air-cooled buffs on which polishing compound has been applied, rotating at 1800 rpm. This process brings out the fine luster of the urea material and removes any scratches or sanding marks which the case may have suffered en route.

Complete assembly of the shaver is made at Schick's plant; the details are not part of this story. But something must be said of the marketing of the product into which so much thought has gone. During the war, the company consistently kept its name before the public by advertising in national magazines. It resumed manufacture of the shavers at the beginning of 1945 with the permission of the War Production Board and at the request of the Armed Forces to satisfy the requirements of wounded men in service hospitals who had facial or hand injuries, frost bite or cuts infected by fungi (as in the South Pacific theatre), who were unable to use anything but an electric shaver. In many cases, men in service grew beards when they found wet shaving too irksome under existing conditions, and the man who had a good electric shaver found himself very popular.

Free Service and Parts to GI's

During the war, Schick inaugurated the policy of supplying service and parts free to all service men who were owners of Schick shavers and who were serving overseas. In addition, free inspection, lubrication and adjustment were offered to all servicemen. Thousands of letters from servicemen have testified to the popularity and general appreciation of this policy.

Schick recently received a letter from a crew member of the *SS President Harrison* which was captured by the Japanese Navy on December 8, 1941. He was able to smuggle a three-year old Schick shaver and transformer into the Japanese prison camp, in which he and 27 other men were located in one barracks. All of them used his Schick shaver—some daily and some every other day, until he was released in August of 1945. He enclosed a certified statement signed by the men that they had used it constantly during the 3½ years since their capture, and had found it completely satisfactory up to the time of their release.

Just as the First World War popularized the safety razor, executives of Schick feel that the Second World War has popularized the electric shaver.

Schick maintains forty strategically located Service Stations throughout the United States and Canada for the repair and adjustment of every model they have produced.

According to Schick records for three years before the war, sales showed a continuous and rapid increase. The *Colonel* model, with hollow ground shearing head, has sold for $15; the *Super* model, on which promotion plans are concentrating now, for $18. A major selling point of the latter is said to be that you can pick it up and start shaving without any elaborate breaking in. So is the case a vital selling point, for the company has found that men are just as style-conscious as women. On the strength of the beauty and functional quality of the shaver, the Schick company is crystallizing an extensive promotion campaign. It will be good advertising for plastics, too. END

We Have A Good Line, Too!

We've been Plastic Molders for 27 years. We feel more than well acquainted with the problems of design, mold-making and molding, because we do all these things right here in our own plant. The principals in this concern know the business from every angle. If you need advice and assistance in the molding of your piece, see one of our sales representatives, or drop us a line.

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Plastic Molding

Sales Representatives: NEW YORK—S. C. Ullman, 56 W. 42nd St. PHILADELPHIA—Towle & Son Co., 18 W. Chelten Ave. Bldg.
NEW ENGLAND—Wm. T. Wyler, 177 State St., Bridgeport, Conn.

plastics

IS NOW A MEMBER OF THE

Audit Bureau of Circulations

plastics is pleased to announce that, after only eighteen months of publication, it has been admitted to full membership in the Audit Bureau of Circulations. The initial ABC audit shows the average monthly net paid circulation for the last half of 1945 to be 9,941. There was a consistent circulation gain each month with the report showing 10,841 in December.

Current paid circulation, as of March 18, 1946, is 11,774, indicating a continuing gain.

At its inception **plastics** promised to bring to its readers the latest developments, procedures and trends in plastics—comprehensive information concerning research, materials, equipment, design and production. But, more than that, it was carefully planned as a medium through which the plastics manufacturer's message could be presented to the end user. There was vital nced for a publication which could present, in understandable, semi-technical terms, the characteristics of plastics, the myriad applications, and the manner in which they could be utilized successfully and economically in the industrial world.

That **plastics** has carried out its announced intentions is proved conclusively by its complete acceptance in the plastics industry itself as well as among the great variety of users and potential users of plastics.

plastics is, and will continue to be, a dynamic force in the whole field of plastics, edited with skill and integrity, dedicated to presenting authoritative manufacturing information and practical merchandising uses for plastics products.

plastics

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ZIFF-DAVIS PUBLISHING COMPANY

185 NORTH WABASH AVENUE, CHICAGO 1, ILLINOIS

Publishers of: PLASTICS★FLYING★POPULAR PHOTOGRAPHY★RADIO NEWS★RADIO-ELECTRONIC ENGINEERING

One of many striking displays at the Second Annual Exhibit featured products for use on the modern automobile

and that of aluminum, excellent electrical properties, and low moisture absorption. It can be made by low-pressure contact methods, and thus does not require the use of expensi dies.

In a survey of paper-based laminates made with comparative low pressures and of the papers used for reinforcement, I Harry F. Lewis, Institute of Paper Chemistry, discussed su matters as types of papers, their good and bad characteristic pulping methods, types of wood, and paper-making conditio all in relation to the properties of laminates. Of particular inte est was the following comment on the use of thermoplastics laminates: If thermoplastic resins could be obtained in a lo molecular form, which would polymerize into a sheet, und conditions of curing, then maybe the thermoplastic resins wou be of great interest in paper-based laminates.

Two developments were chosen by Dr. Gordon N. Klin National Bureau of Standards, to feature his talk on plasti in Germany, namely the manufacture of a German "compre and the production of vulcanized fiber. The resin-bonded cor pressed laminated wood was known as *Lignofol*. It was use for propellers; aircraft dies, bearing plates, and casters; and te tile equipment. The veneer was beech, and the resins or a hesives were alcohol soluble, cresol-form resins, designated *T 3-S* and *Tagofilm*.

For the preparation of vulcanized fiber in Germany, sulphi paper was used rather than rag stock, because of the shorta of fabric. The vulcanized fiber was made by the zinc chloric process, which is also used in this country, and by the sulphur acid process for the treatment of the cellulose, when vulcanize fiber sheets of 1/10 to ½ mm thicknesses were desired. Th form sheets which resulted were cemented with a urea forma dehyde adhesive. An important use was gasoline tanks for ai craft.

C. A. Woellert, American Cyanamid, discussed the gener field of decorative laminates. Such laminates—familiar as cou tertops, table surfaces, bar tops, and similar applications—ar expected to be in wide demand because of their durability, colo and fine appearance. We shall, however, need all of the in

SPE Convention and Exhibit

Part II

THE summaries and abstracts of the papers presented at the recent SPE Convention in Detroit, began in the February issue, are herein concluded. Some of the papers (see W. Goggin's paper in this issue) are on schedule for full publication. The abstracts follow.

In a paper titled "Semi-Structural Fabrications," C. F. Marschner, Forest Products Laboratory, surveyed the development of paper-based laminates of the structural type (see article on *Papreg* in February, 1945, ***plastics***) to meet the following specifications: laminating pressure of 250 psi or less, removal of the panel from the press while still hot, uniform strength properties in all directions, and high strength and rigidity. From studies made, definite conclusions were reached concerning thickness, density, and other properties of the reinforcing paper; best resins to use under specified conditions; types of paper needed to eliminate high molding pressures, to give desired fiber alignment, etc.; percentage of resin content, etc. The special point was made that lignin resins in amounts up to 50% of the total resin can be used to extend the phenol without affecting either molding or mechanical characteristics.

H. W. Collins, Owens-Corning Fiberglas Corp., spoke on "Engineering Properties of Fiberglas Reinforced Plastics." The development of Fiberglas-reinforced low-pressure laminates by the Fiberglas Corporation, eight resin companies, and Wright Field was briefly reviewed. This material has proved stronger on a strength-weight basis than many metals, and in fact may be looked on as a new "metal" because of its characteristics and the structural and engineering opportunities it has created. Laboratory samples of the new material have tested as high as 80 ft-lb impact (Izod) per in of notch and 175,000 psi in flexture. The material has a thermal expansion between that of steel

provement brought about by war-time developments, plus in agination and ingenuity, to satisfy the extensive demands place on our industry by the public.

The two classes of materials used in decorative laminates ar the amino plastics and a newer type, the copolymer and anhy drous resins. The principal amino plastics used are ureas an melamines. The melamines are relatively new to the decorativ field, but possess the advantages of resistance to moisture, hea and abrasion. The second class, developed during the past tw or three years, may be broadly called the anhydrous thermoset ting resins, sometimes called copolymer, unsaturated polyester low pressure or contact laminating resins. They were develope for war uses and proved successful in many applications in bot formed and sheet laminates.

These new resins remain something of a dark horse in the fiel of decorative laminates. Their low-pressure cure possibilitie make them applicable to continuous production. They are capa ble of producing laminates of high decorative value, excellen service, good color retention, good abrasion resistance, and ex cellent resistance to the effects of solvents. The fact that inex pensive equipment is needed to fabricate these laminates make them a natural in the decorative field.

Decorative laminates in such uses as table tops, bars, counters wall and door panels and covering, doors, venetian blinds, an interior decorative trim offer to the designer the opportunity o broadening the decorative aspects of our everyday life.

The next paper, by T. Walter Noble, Fabricon Products, Inc. dealt with "Low Pressure Molding—Materials and Technique

In treating or impregnating the base material, the three genera methods employed are the squeeze roll method, the doctor knif

(*Continued on page* 105)

I Beg to Differ!

Contingent upon reader response, an open forum or letter column is planned as a departmental feature to run from time to time as the occasion warrants

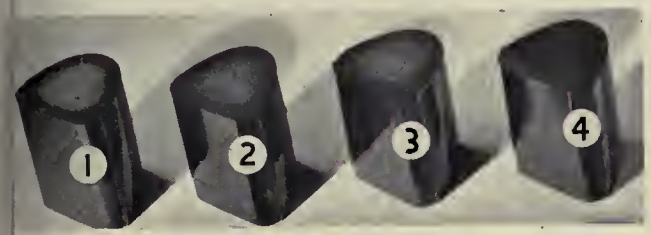

Fig. 1 shows effects of preheating. Compression molding charges were treated thus: 1—no preheat, unit molding time; 2—moderately warmed, 30% less molding time; 3—preformed and warmed, 40% less molding time; 4—preformed and preheated by high frequency, molding time reduced 90%

THE article "High Speed Molding of Thermosetting Resins" by Charles J. Smith in your November issue describes some of the advantages obtainable from transfer (injection) molding of thermosetting compounds with high frequency preheated charges. In all fairness to compression molding and the many compression molders, we would like to point out that compression molded products are not porous when they are properly molded. Excellent molded parts may be produced by the compression process and, in some cases, it is the correct and logical mold type. The use of high frequency preheating in combination with compression molding will give very fast molding speeds and insure freedom from porosity.

The molded pieces in Fig. 1 illustrate the effect of preheat on the compression molded charge with variations in the degree of preheat. It will be noted that full density was obtained and that the cycle was reduced to a minimum when high frequency preheat was used. Full density would have been achieved in the other three cases if a transfer mold had been used.

The pressure type of transfer mold shown in Fig. 2 and

(*Continued on page 92*)

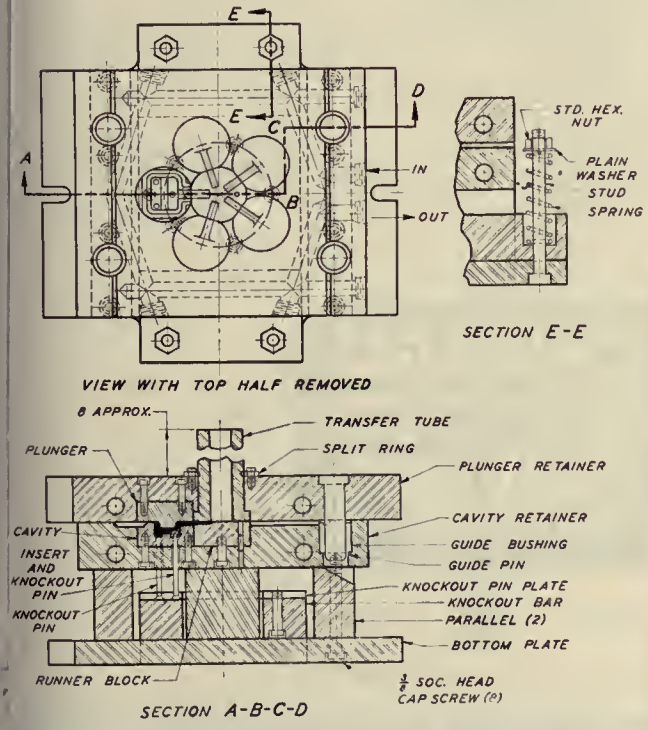

Fig. 2. This is a drawing of a pressure type transfer mold, of the kind described in the article in question

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Here is one of the mast difficult problems we ever had to surmount: Note its complicated structure, its multiplicity of wall thicknesses, and the way its unique louvre design conceals the speaker aperture!

This is but one of the many "impossible" assignments now being executed in our injection molding department (and in the laminating and fabricating departments, too). If you have a similarly complex problem, consult our Design and Engineering Department, and ask for our new catalog No. 3-A, showing hundreds of products in plastics—similar to those we can make to your specifications.

ARMY NAVY

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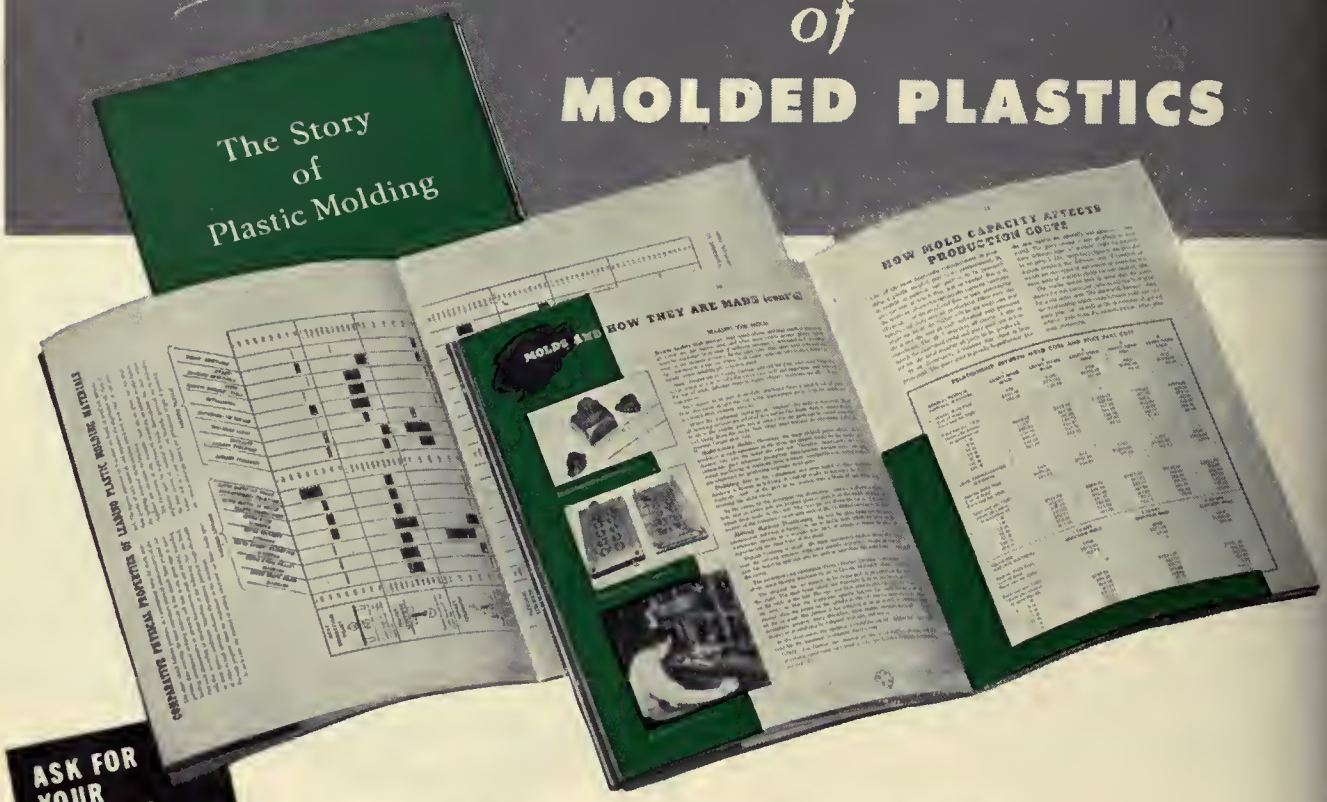
For Buyers . . . and Prospective Buyers of
MOLDED PLASTICS



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Are plastics applicable to your needs? . . .
Which plastic is best suited to your job? . . .
How will design affect production volume and cost?

These are some of the things you should know *before* you have gone far with your plans and *before* you have designed the part to be molded.

These questions, and many more equally pertinent, are authoritatively discussed in our new book, "The Story of Plastic Molding." Charts, tables, and illustrations are used prolifically to explain each point. Result—a clearer understanding of the possibilities of molded plastics for your particular use, as well as their limitations.

Yes—this book is brimful of down-to-earth facts . . . information that is based on our quarter century of experience in plastics. We believe that you, like thousands of others, will find it useful and valuable . . . a book you will want to keep and *use*.

Write for your copy today . . . on your firm letterhead, please. There's no charge . . . no obligation.

Here are a few of the subjects covered:

- When to use molded plastics (also when *not* to use them).
- Choosing the right material.
- Comparative physical properties of molding materials.
- The molding process.
- How molds are made.
- Relationship between mold cost and piece part cost.
- Designing for plastic molding.

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Branch offices in key industrial centers

COMPRESSION AND INJECTION MOLDING OF ALL PLASTIC MATERIALS

WHAT'S *New* IN PLASTICS

New Buffing Compound

Great American Color Co.
512 W. Ninth St.
Los Angeles 6, Calif.

Gamco, a new buffing compound made especially for use in finishing acrylics but said to perform almost equally well in finishing other plastics, is reputed to perform much better and faster than older compounds, to grind and polish without burning, and to eliminate the necessity of sanding. According to the company, best results are obtained when the compound is worked in between the layers of cloth on the buffer wheel. It is applied by being held against the buffing wheel in motion until the surface of the wheel is evenly glazed.

Gamco is said to contain only the finest ingredients, scientifically blended, and not to contain jewelers' rouge or greases. The ability of the compound to dissipate buffer heat so that plastics articles are not buff burned even though held firmly and steadily against the buffer wheel is ascribed to its fast grinding action and a blending of the proper grits and solvents..... (492)

Hydraulic Forming Presses

Buffalo Gasolene Motor Co.
280 Niagara St.
Buffalo 13, N. Y.

Designed for use in the manufacture of small plastics articles, these presses which have been added to the company's postwar line are available in any required pressure capacities and equipped to meet individual manufacturing needs; they are manually operated, with hand or foot control, and safety features incorporated.

The 20-ton press illustrated has a 24" by 36" bolster plate, 24" gap, 12" stroke, weight of approximately 4200 lb, and occupies floor space of 38" by 53" with overall height of 87". Controlled pressure is exerted throughout the entire stroke with positive, uniform pressure at point of contact, and pressures are plainly visible by means of a dial type gage. It is one of a number of such presses developed by the company to meet the requirements of the Rudolph Wurlitzer Co.

Cited as a feature of the hand-operated press is its two-lever safety operation; motor, pump and tanks are enclosed in base; precision ram speed and manual reversal are accurately controlled. ..... (493)

Spinner-Riveter

Plymouth Engineering Co.
Plymouth, Ind.

Designed especially for assembly of fragile materials, this new spinner-riveter, called the Keyn *Airflex*, is intended for all types of cold headed assemblies and is said to be particularly adaptable for use in work on such materials as plastics, fibre, insulating materials, and canvas.

The adjustable spindle regulator of this unit, for precise control of riveting force under maximum speed, is described as a unique feature which widely increases the scope of uses for cold heading on either ductile or brittle materials.

In operation, the spinner-riveter utilizes a relatively narrow-faced tool which contacts only a fraction of the rivet at each blow, and is rotated while a pneumatic hammer strikes a series of rapid blows, the rotation spreading the peening over the entire surface of the rivet head; pressure is confined to the rivet itself. The unit can be used for riveting small as well as large fragile parts, through a wide range of sizes of pistons.

Hammers are interchangeable over the entire range of sizes of rivets, and piston diameters from ½" to 1½" handle work up to ½" diam. ..... (494)

Improved Wet Belt Surfacer

Porter-Cable Machine Co.
Syracuse 8, N. Y.

Said to incorporate features which greatly increase its output, an improved wet belt surfacer, *Model BG8*, which surfaces, grinds and removes stock by means of an abrasive belt is announced by this company. High production, close tolerance performance and superior finish are offered by the improved machine, according to its makers.

It is equipped with a larger capacity recirculating tank for longer operational performance, and the coolant, applied to work and belt with a spray nozzle, is said to keep the work in constantly cool condition and to prevent possible weakening of the structure of certain types of materials such as plastics, rubber, ceramics, glass and tempered metals. For space conservation, the depth of the machine has been reduced from 62½" to 48".

Among specifications listed for this *Model BG-8* are: Automatic feed table working area 11¼" by 24½"; abrasive belt speeds, 4100 sfpm, standard, and operational speeds of 2500, 3550, or 4600 sfpm can be furnished; motor speed 1725 rpm; drive units, 5 hp 220/440, 60 cycle, 3 phases; 7½ hp motors available ..... (495)

Unusual Tool

Power Weld Co.
419 Kent Ave.
Brooklyn, N. Y.

Described as "a new method of welding, brazing or surfacing with infinite compositions of powdered materials," this recently announced equipment is known as *Power Weld*. It consists of a torch fashioned along the general outlines of an ordinary welding torch but having a special patented nozzle and 16 independent controls, many of which are at the handle of the tool; a control box with air and gas pressure regulating valves and a canister from which powdered materials are fed through the flame which is generated and controlled by pre-selected combinations of gasses and air.

The tool is said to be finding considerable immediate usage in surfacing with plastics such as polythene, certain polyvinyls

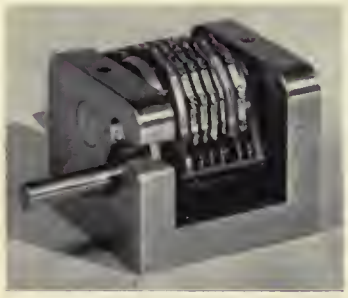
In rapidly-moving times such as these, keeping up with every latest development in one's field is a "must." In order to simplify for our readers the task of obtaining detailed information regarding the new products, processes and trade literature described herein, ***plastics*** has keyed each item in this section with a number, and has provided the name and address of the manufacturer or producer of each.

Mention of the key number, and of the issue of ***plastics*** in which the news item appeared, will serve as quick identification of the product when writing the individual manufacturer or producer for further details.

and some elastomers, and its application in the plastics field is said by its makers to be rapidly expanding.....(496)

Hot Stamping Numbering Head

Wm. A. Force & Co., Inc.
180 N. Wacker Drive
Chicago, Ill.



A heavy duty hot stamping numbering head designed for insertion in place of marking die in head of standard hot stamping machine, when automatically numbering plastics parts.

Designed to withstand heat application, and in several sizes of figure for various work, the numbering head is available with regular numerical sequence and with special sequences such as those for duplicate, triplicate, or skip numbering.....(497)

Compact Preheater

Airtronics Mfg. Co.
5245 W. San Fernando Rd.
Los Angeles 26, Calif.

Measuring 18 by 22 by 36 in, this new *Airtronics* 2.5 kw preheater is described as being designed for rigorous production schedules and continuous operation, with powerful vacuum cooling of high frequency components provided.

Following the principle of certain other *Airtronics* models, this new preheater makes possible the heating of two entirely different loads alternately or in any sequence, without adjustments of any sort between heats, as, according to description, operation is entirely automatic after initial adjustment of power output and heating time for the two loads.

Simplicity and ease of operation are listed as features of this product, convenient access being provided for control chang and servicing .....(49

To Heat Plastics Compounds

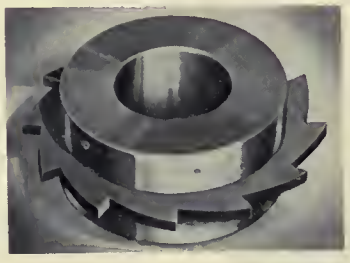
D. C. Cooper Co.
20 E. 18th St.
Chicago 5, Ill.

An electrically-heated, thermostatically-controlled dip tan equipped with stainless steel thermometer, designed especial for heating ethyl cellulose compounds. The jacketed portion the tank, according to description, contains a special heat transf oil insuring even temperature throughout, with intake and dra for oil and drain for the plastics.

Heavily insulated, with insulated lid, the tank measures, i 22" by 10" by 10", and is said to meet requirements for plasti dipping of a variety of items.....(499

Carbide Slitting Saw

Gay-Lee Co.
117 E. Hazelhurst Ave.
Ferndale 20, Mich.

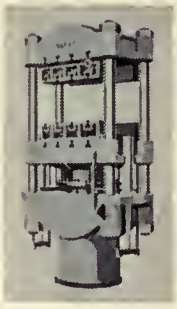


Designed for use in cu ting plastics and ceramic a newly announced saw described as being mac with a unique steel hu permanently bonded to th cemented carbide blad thus eliminating fracturir due to strain imposed t mounting screws and nut and giving support to th cutting edge.

Generated tooth design to supply maximum strength, slight concave shape for clearance, resistance to abrasion, and cuttin to exceptionally close tolerances, are also claimed as properti of this product.

The saw is available in standard sizes, as well as in speci sizes which are made to customers' specifications.....(500

Gorski Bros.



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Our complete line of standardized designs including 50 to 575 ton capacities within a few weeks after placing of order.

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It is our policy to work with you on any of your problems involving compression molding with hydraulic equipment. We will assist in laying out and designing your molding room and we will supervise the installation of our presses in your plant. We will also set up your first mold and train your personnel in the operation and maintenance of our equipment.

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EXECUTIVE SALES OFFICES
600 NORTH ST.
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Literature Review

High Frequency Heating

Thermex Div., The Girdler Corp.
Louisville 1, Ky.

An attractively prepared and colorfully illustrated booklet listing and describing various uses of the company's *Thermex* high frequency dielectric heating equipment, its applications in heating preforms for molded plastics; in the fields of plywoods, laminates, chemicals, and numerous others.

Brief description and listing of characteristics of certain of the *Thermex* units are included in the booklet, as well as details of the company's engineering service offered in connection with the equipment, and various other pertinent data.....(501)

Cumberland Catalog

Cumberland Engineering Co.
Box 216, Providence 1, R. I.

Recently-announced descriptive catalog in which are illustrated four sizes of the company's machines expressly designed for the purpose of granulating plastics materials, for the manufacturer of molding compounds and for the molder, for reduction of scrap. All four of the machines are shown assembled and dismantled, together with construction diagrams.....(502)

Special Service Booklet

Behr-Manning Corp.
Troy, N. Y.

Entitled "Your New Laboratory, Sir," this booklet announces what the company describes as "a pioneering service in the coated abrasives industry," in Behr-Manning's provision of branch-located methods and equipment demonstration rooms for the use of industrial customers who wish to pre-test their

"A TRULY MODERN LIGHT"

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GEMGLO TORCH

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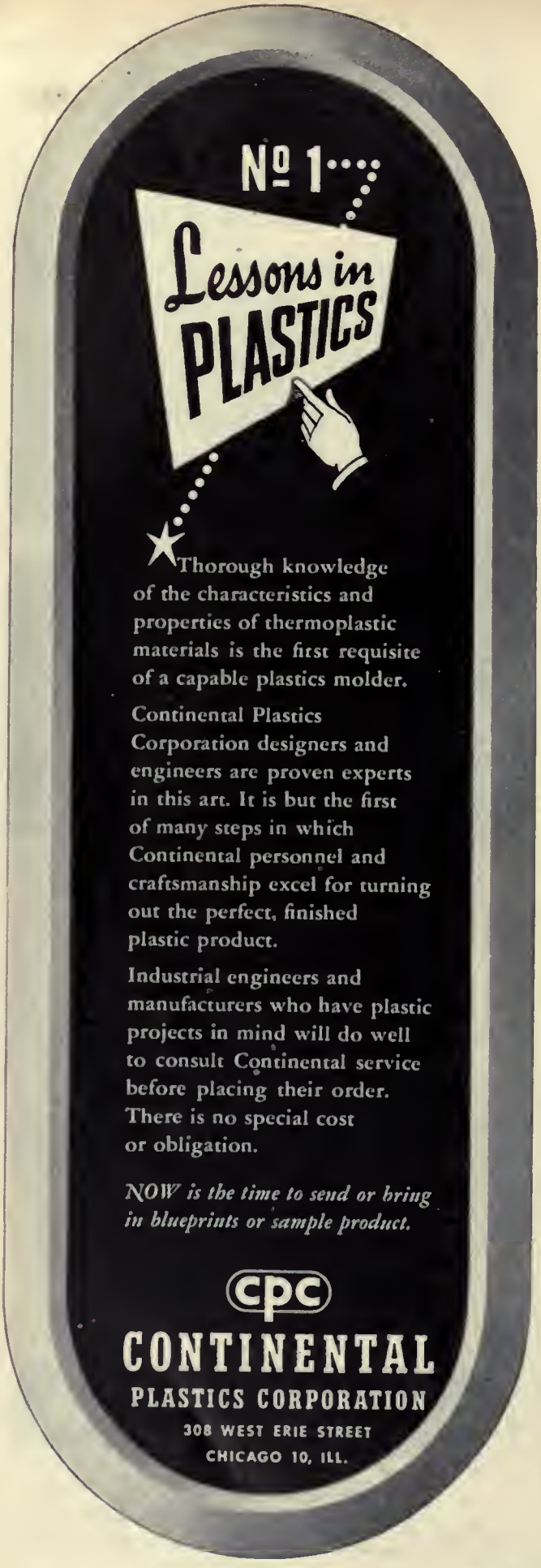
No 1
Lessons in
PLASTICS
Thorough knowledge of the characteristics and properties of thermoplastic materials is the first requisite of a capable plastics molder.
Continental Plastics Corporation designers and engineers are proven experts in this art. It is but the first of many steps in which Continental personnel and craftsmanship excel for turning out the perfect, finished plastic product.
Industrial engineers and manufacturers who have plastic projects in mind will do well to consult Continental service before placing their order. There is no special cost or obligation.
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grinding, sanding and finishing tool-ups on standard commer equipment without disturbing their plant production schedu

The booklet contains photographic illustrations of vari phases of this service, taken in the company's demonstrat rooms in six of the cities where these special facilities h already been established, with concise description of the eq ment and service.....(5

Ajax Steel & Forge Co.

205 Adair St.
Detroit 7, Michigan

Specifications, approximate weights, tables and various ot details of interest to makers and users of tools, dies and mc are set forth in this compact, pocket-sized booklet.

Comprehensively indexed, and designed for convenient ref ence, the booklet supplies information, in quickly readable fo on the company's products .....(5

Polymerized Resin

Naval Stores Dept.
Hercules Powder Co., Inc.
Wilmington 99, Del.

Compactly-arranged booklet describing the physical and ch ical properties, color grades, and applications of *Poly-pale*, company's polymerized resin which is light in color and hi melting, and is finding wide use in the production of ester gu gloss oils, spirit varnishes, adhesives, in modified maleate phenolic resins, paper coatings, linoleum, and in a number other fields, according to its description.....(5

Industrial Chemicals

American Cyanamid & Chemical Corp.
30 Rockefeller Plaza
New York, N. Y.

A handy, concise and efficiently arranged listing of chemi and allied products of the company; the chemicals are listed alphabetical order, and articles are classified, according to th industrial use, in alphabetical sequence. There are several pa of data on some of the company's available bulletins which a plify the brief details, given in the booklet, upon specific che cals and their uses.....(5

Grinding Machine Booklet

Cincinnati Milling & Grinding Machines, Inc.
Cincinnati 9, Oho

Engineering data covering the principal products of Cinc nati Grinders, Inc., arranged for quick and easy technical ref ence.

The booklet, designated as *No. G-356*, contains general spe fications and dimensional drawings on each machine listed, well as a photographic illustration of each, and speedy referen is further facilitated by means of an explanatory listing of c tents .....(5

Diamonds in Precision Work

F. F. Gilmore & Co.
285 Columbus Ave.
Boston, Mass.

A well-prepared and detailed booklet *(Catalog No. 46)* p viding information on the uses of diamonds in precision ma facturing such as machining, grinding, hardness testing, a other operations. Various examples are shown in the catal which is adequately illustrated throughout its 36 pages.

It supplies data on diamond boring tools, turning and faci tools, gage contacts, styli, abrasive tools, engraving tools, e and is indexed for ready reference.....(5

New Instruction Pamphlet

Synvar Corp.
Wilmington, Del.

Recently released, this pamphlet covers a series of the co pany's room-temperature setting, resorcinol-formaldehyde resi which are produced in four grades and designated as *Synvar PLS-AA, Synvaren PLS-A, Synvaren PLS-1*, and *Synvar PL-2*.

The instruction pamphlet is part of Synvar's "blue bookl describing the company's full line of wood-resin adhesives a their uses .....(50

PROBLEMS in *plastics*

Problems and questions may be submitted to this department for answering by the technical editors or specialists in the Industry.

Please send a list of molders who may be able to supply large quantities of small plastics beads or balls which will be required in various sizes, such as ¼" diameter, 5/16" diameter, and perhaps 3/8" diameter. It is preferred that they be hollowed with a thin slide wall and with a hole suitable for threading on other material. J. C. V., Grand Rapids, Mich.

We suggest that you get in touch with the following injection molders in your vicinity who mold beads and balls and who may be able to supply the sizes you want: American Plastics Engineering Corp., 414 Curtis Building, Detroit 2, Mich.; Detroit Development & Manufacturing Co., 3211 Barlum Tower, Detroit 26, Mich.; Detroit Macoid Corp., 12340 Cloverdale, Detroit 4, Mich.; and Michigan Molded Plastics, Dexter, Mich.

* * *

Can you suggest a source of supply of round or square plastics containers ranging in size from ½" by ½" by ¼" up to 5" by 5" by 2". E. A. G., New York City.

Try the following companies, some of whom can undoubtedly supply the items you wish or can steer you to a supplier: Clover Box & Manufacturing Co., 824 E. 140th St., New York 54, N. Y.; Duranol Products, Inc., 63 Tiffany Place, Brooklyn 2, New York; Excel Plastics Co., 535 Fifth Ave., New York City; Goodyear Tire & Rubber Co., 1144 East Market St., Akron, Ohio; Irwin Corp., 27 W. 20th St., New York 11, N. Y.; and National Fabricating Co., 129—01 North Conduit Ave., South Ozone Park 20, N. Y.

* * *

Please recommend the type of plastics sheets to use in the construction of a theater front 21' high and 14' wide from strips of plastics, remembering that the plastics will be exposed to all sorts of weather. S. B. N., Provo, Utah.

We recommend lominoted plostics for the job and suggest you write the Formica Insulotion Co., 4620 Spring Grove Ave., Cincinnati 32, Ohio, a supplier of such materials.

* * *

We wish to develop a process to spray a high glossy transparent finish on book or pamphlet covers after they have been printed, similar to the process used prior to the war on "Pocket Novels" covers, the trade name of which was *Perma-Gloss.* Please give us any information you can on the materials for the process or the name of any company making equipment to do this work. D. S. W., Toronto, Canada.

You con obtain information regarding moterials and equipment for the production of the glossy finish you desire from the Celanese Plostics Corp., 180 Madison Ave., New York 16, N. Y.; Tennessee Eastman Corp., Kingsport, Tenn.; and Bakelite Corp., 30 East 42nd St., New York 17, N. Y.

* * *

What is the usual method in the plastics trade of amortizing the cost of molds? K. G., New York.

The usuol custom is to estimate production for two yeors and plon to amortize tooling costs ovcr thot time.

* * *

Please send the address of the Hoffman Manufacturing Co., which is mentioned in the article "Plastics in Quality Jewelry" in your September, 1944, issue. B. L., Stockholm, Sweden.

The Hoffman Co.'s oddress is 62 W. 47th St., New York City.

THE TIME IS COMING . . .

WHEN YOU may require *specialized* experience on vinyl resin, pyroxylin or other plastic coatings.

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We Specialize in COATED FABRICS FILM, PAPER

BORTMAN PLASTICS Company

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INDUSTRY HIGHLIGHTS

Organization of British Geon Ltd., for the manufacture of plastics materials and copolymers in the United Kingdom, by B. F. Goodrich Chemical Co., Cleveland, and Distillers Co. Ltd., England, has been announced. The new company will engage in the production and sale of *Geon* materials.

A major program of expansion, involving extensive additions to present buildings and plant equipment, has recently been announced by Chicago Molded Products Corp. Undertaken to meet accelerated postwar demand for the company's services, according to Edward F. Bachner, president, the program, which is now under way, is planned to carry on through 1947. An addition which is nearing completion will house the company's thermoplastic division, it is expected, by late spring or early summer of the current year.

The announcement further advises that a substantial number of new presses have already been bought, and that additions to plant space already purchased total more than 40,000 sq ft.

A new thermoplastic injection molding compound has been announced by Rohm & Haas, Philadelphia. Designated as *Plexene M*, the new powder is a modified polystyrene, and it is said to exhibit marked strength improvement over regular polystyrene compounds and over methyl methacrylate molding powders, and to have displayed excellent dimensional stability and color retention, under rigid tests. It has high chemical resistance to acids, alkalis, dilute alcohol and gasoline, but is attacked by certain organic solvents such as acetone and ethylene dichloride.

Plexene M has a heat distortion temperature of 192° F; a power factor higher than that of unmodified polystyrene, but considerahly lower than that of methyl methacrylate; it is said to be odorless and tasteless, and is available in translucent and opaque shades from ivory to black.

Completion of the work of expanding the production of Tennessee Eastman Corp., Kingsport, Tenn., which is now under way, is expected to result in an increase of 30 per cent in capacity for yarn and staple by the end of the year 1946, with a corresponding increase in production of the company's *Tenite* and the addition, during the next two years, of about 2000 employees to the approximately 7000 now in the company's employ. The expansion work, it is expected, will be carried on over 1946 and 1947, and it has been stated by James C. White, president of Tennessee Eastman, that operation of three of the buildings is scheduled to begin by July 1 of this year.

Opening of a new Chicago sales office at 30 N. Dearborn St. has been announced by Glyco Products Co., Inc., Brooklyn, N. Y. The office is under personal supervision of Dr. George H. Goodyear, assisted by David J. Dean and Paul Sanderson who will handle technical sales of the company's emulsifying agents, polyhydric alcohol esters, synthetic waxes and other special chemicals.

Recently announced by Lester Tarr, president of the Cinch Mfg. Corp., Chicago, was the purchase by that company of the assets of Howard B. Jones Co., also of Chicago. The announcement further stated that plans are to continue production of all of the Jones Co. products under the new management, of which

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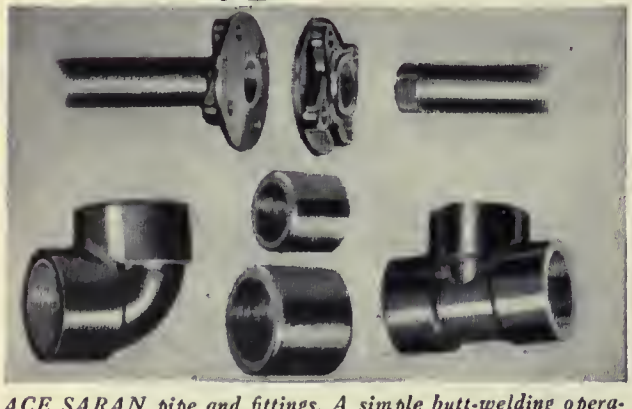

ACE SARAN pipe and fittings. A simple butt-welding operation makes it possible to assemble large Saran pipe lines on the job without use of threaded fittings, when desirable.

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Ace Saran is available in a wide variety of applications, including pipe and fittings, rods, tubes, sheets, rattan and mono filament. You will find one or more of these Saran products economical and useful in your operations. Our research and engineering staffs stand ready to serve you, with no obligation.

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Branch Sales Offices: 111 West Washington Street, Chicago 2, Ill., Akron 4, Ohio

Cary Wilson is general manager, and to retain most of the company's personnel, with Howard B. Jones acting in a consultant capacity on Jones products.

Cinch Mfg. Co. is a wholly-owned subsidiary of United Carr Fastener Corp., of which the Hon. Sinclair Weeks is chairman of the board, Arthur W. Kimbell, president, and Mr. Tarr, vice president.

The fourth chapter of the technical handbook being developed by the Engineering and Technical Committee of the Society of the Plastics Industry will be available by April 10, according to announcement from the Society.

This chapter, titled "Testing Plastics Parts," relates primarily to tests which are given various finished articles to ascertain their potential durability under consumer usage, and are intended to serve as important guides to manufacturers in establishing performance tests for their own products and as a means of insuring consumer satisfaction. Among the tests described in the chapter are: Impact tests to determine the strength and resistance of various products to shocks; tests for moisture resistance; for ascertaining dimensional stability, heat resistance; crushing tests; and others, designed to bring out facts which will facilitate production of "top-grade" items.

Advising that one of the organization's departments is devoted exclusively to the developing and designing of plastics products for the industry, and that its staff of skilled engineers is capable of designing any injection or compression molds, Arnkurt Associate Engineers, 82 Beaver St., New York, has announced the availability of its services as consulting engineers.

The organization, with offices established October 1, 1945, is headed by Arnold W. Runge and Curtis F. Pearl.

Two new plasticizers said to be high in efficiency and compatibility, with excellent low-temperature flexibility, and to be finding wide use in the making of plastics shoe soles, rainwear,

Mirror Finish

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Consultation, functional analysis, product styling or restyling, selection of correct materials, design of molds, dies, tools, model making . . . by the creators of more successful plastic products than any other similar organization in the world.

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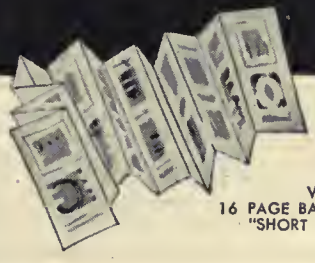

STAFF OF 181 TWELFTH YEAR

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16 PAGE BARNES & REINECKE BROCHURE
"SHORT CUT TO RECONVERSION"
NO OBLIGATION

hospital sheeting, sanitary goods and other coated fabrics, as well as in wood rubbing lacquers and metal furniture lacquers, have been announced by Resinous Products & Chemicals Co.

Designated as *Plasticizer 35* and *Plasticizer 36,* these products were originally developed as plasticizers for polyvinyl chloride and copolymers, to meet a wartime need. Further development is said to have proved them equally efficient as plasticizers for polyvinyl butyral, nitrocellulose, and synthetic rubbers, in all of which they function as monomeric elasticator type plasticizers.

Solubility of *Plasticizer 35* in water, at 25° C, is given as 0.007%; that of *Plasticizer 36,* 0.10%.

The program of plant expansion which had been scheduled by Columbia Protektosite Co., Inc., prior to 1941, and which was shelved during the war, is now under way, advises Joseph Brunetti, president of the company. The New York Eye Shield Division, formerly located in Carlstadt, N.J., has been moved to East Rutherford, N.J., operation at this new plant, which contains 22,000 sq ft of floor space, being under direction of Lazzaro Fattori, the company's treasurer. A new addition which, when completed, will add 50,000 sq ft to the main Columbia plant in Carlstadt is under construction, and plans for a new factory, modern in the utmost detail, have been announced.

A new plasticizing resin, described as a clear amber, resinous oil with a vague phenol odor, highly viscous and slow-flowing, with good color retention, has been placed on the market by The Neville Co.

The product, which is called *Nevillac TS,* is said to be soluble in practically all solvents except water, glycerine and higher polyhydric alcohols; miscible with ethylene glycol and its di- and tri-derivatives; and compatible with zein, cellulose derivatives, terpene, alkyd, phenolic, vinyl and coumarone-indene resins.

A shaping or bending process analogous to post-forming, which has been achieved with decorative laminates, by Formica Insulation Co., was reported by George Clark, vice president and chief engineer of the company, in a recent talk before a meeting sponsored by the Technical Committee of the American Institute of Architects, in New York. In altering the shape of the flat laminate, its surface qualities are not affected, said Mr. Clark, as, by proper manipulation, the distortion caused by the process can be made to take place at the back of the core. In addition, Mr. Clark reported that Formica Insulation Co. is laying greater stress in its laminates on a pigmentized paper impregnated with melamine resin, rather than on a pigmentized film on the surface of the core material.

The opening of new sales and executive offices for Myler Plastics Corp., at 730 Fifth Ave., New York, was recently announced by E. W. Myler, president of the company. At the same time, Mr. Myler announced satisfactory progress on construction of the company's new factory for large scale production of its cold mold plastics powders, at Plainfield, Conn.

A school, established primarily for the benefit of returning servicemen who are interested in entering the plastics field, has been opened in Denver, Colo., by J. A. Sundstrom, president of Lifetime Plastic, Inc. Named the Plastics Training Association of America, the school's program provides for classes in various phases of plastics manufacturing.

Inorganics, Inc., Knoxville, Tenn., has appointed the Fisher Chemical Co., New York, sole agent for the sale of its benzoyl peroxide in the United States.

A high-speed catalyst with which, it is said, thermosetting plastics castings can be hardened in twenty minutes or less, has been developed by Duorite Plastic Industries, Culver City, Calif. Designated as *Accelerator No. 70,* the product, originated for use in connection with phenolics such as Duorite's *Plastitool,* is described as having a low-corrosive acid base combined with a plasticizer which acts as a buffer for exothermal heat. Descrip-

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- Unsurpassed in originality

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- ☒ Spatulas
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- ☒ Spreaders, Mustard
- ☒ Trays, Ice Cube

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- ☒ Frames, Picture
- ☒ Ornaments
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- ☒ Pulls, Lamp
- ☒ Pulls, Window Shade

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- ☒ Bases, Pen
- ☒ Binders, Plastics, Book
- ☒ Calendars
- ☒ Cases, Pen and Pencil
- ☒ Ends, Book
- ☒ Frames, Photo
- ☒ Holders, Blotter
- ☒ Holders, Card
- ☒ Knives, Razor Blade Holding
- ☒ Openers, Letter
- ☒ Pads, Appointment
- ☒ Rulers
- ☒ Sets, Desk
- ☒ Stands, Calendar
- ☒ Stands, Pen
- ☒ Trays, Paper Clip
- ☒ Trays, Pin
- ☒ Weights, Paper

Bedroom and Closet
- ☒ Boxes, Knick-Knack
- ☒ Boxes, Utility
- ☒ Hangers, Coat
- ☒ Hooks, Coat
- ☒ Racks, Tie
- ☒ Shoehorns
- ☒ Spoons, Slipper

Sewing Room
- ☒ Buttons, Lapel
- ☒ Dispensers, Toothpick
- ☒ Dispensers, Soap
- ☒ Needles, Knitting

Nursery
- ☒ Animals, Toy
- ☒ Rattles
- ☒ Rings, Teething
- ☒ Toys

Bathroom and Powder Room
- ☒ Boxes, Powder
- ☒ Boxes, Soap
- ☒ Boxes, Tooth Brush
- ☒ Cases, Lipstick
- ☒ Cases, Rouge
- ☒ Closures
- ☒ Compacts
- ☒ Cups, Eye
- ☒ Curlers, Hair
- ☒ Dishes, Soap
- ☒ Dispensers, Soap
- ☒ Holders, Razor Blade
- ☒ Holders, Soap
- ☒ Holders, Tumbler
- ☒ Lipsticks
- ☒ Manicure Articles
- ☒ Razors, Safety
- ☒ Sticks, Orange

Game Room, Sports, Musical Instruments and Hobbies
- ☒ Balls, Golf
- ☒ Boxes, Playing Card
- ☒ Chess and Checkers
- ☒ Chips, Poker
- ☒ Chop Sticks
- ☒ Flashlights
- ☒ Floats, Fishing
- ☒ Fishing "Plugs"
- ☒ Games
- ☒ Instruments, Musical
- ☒ Knives, Pocket
- ☒ Parts, Music. Instrument
- ☒ Racks, Poker Chip
- ☒ Reeds, Music. Instrument
- ☒ Tackle, Fishing
- ☒ Trays and Tanks, Film Developing
- ☒ Whistles

Garden, Shop and Garage
- ☒ Decorations, Furnitura
- ☒ Drapery Hardware, Rods, Rings, Tie Backs, Pulls, Cords and Cranes
- ☒ Handles
- ☒ Hardware, Rods, Rings, Tie Backs, Pulls
- ☒ Knobs
- ☒ Knobs, Door
- ☒ Letters
- ☒ Numbers, Housa
- ☒ Plates, Kick
- ☒ Plates, Light Switch
- ☒ Plates, Name
- ☒ Plates, Door Push
- ☒ Protectors, Eye
- ☒ Pulls, Drawer
- ☒ Pulls, Venetian Blind

Beverage and Smokers Accessories
- ☒ Boxes, Cigaretta (Moldad)
- ☒ Boxes, Match
- ☒ Cases, Cigaretta
- ☒ Coasters
- ☒ Holders, Match
- ☒ Jiggers, Liquor
- ☒ Muddlers
- ☒ Picks, Cocktail
- ☒ Scrapers, Beer
- ☒ Spears, Cocktail
- ☒ Spoons, Highball
- ☒ Stirrers

Jewelry and Personal Adornment
- ☒ Barettes
- ☒ Banks, Coin
- ☒ Boxes, Jewel
- ☒ Bracelets
- ☒ Buckles, Belt
- ☒ Cases, Key
- ☒ Chains, Key
- ☒ Charms
- ☒ Clips, Costume
- ☒ Compacts, Powdar
- ☒ Crystals, Watch
- ☒ Ornaments, Hair
- ☒ Ornaments, Hat
- ☒ Ornaments, Lapel
- ☒ Pins, Bobby
- ☒ Rings, Finger
- ☒ Stones and Jewels

Miscellaneous
- ☒ Dials, Instrument
- ☒ Dials, Radio
- ☒ Eyes, Artificial (Parts)
- ☒ Lenses
- ☒ Religious Goods
- ☒ Tags Key (Hotel)

Store Fixtures and Supplies
- ☒ Cements
- ☒ Closures, Bottle and Jar
- ☒ Decorations, Furniture
- ☒ Fixtures, Display
- ☒ Holders, Bin Label
- ☒ Holders, Drawer Label
- ☒ Markers, Price
- ☒ Parts, Furniture
- ☒ Signs
- ☒ Tags

tion adds that while the new catalyst will produce excellent results in opaque castings, it cannot, because of its extreme activity, be satisfactorily used to produce translucent or transparent castings. Resins polymerized with *Accelerator No. 70* may contain both pigments and fillers.

A program of long-range research designed to "improve service to the public by providing guidance for wiser applications of plastics in consumer products" has been started at the Massachusetts Institute of Technology, according to announcement from the Plastics Materials Manufacturers Association, Inc.

The work at M.I.T. will be under the supervision of Professor A. G. H. Dietz, of the department of building engineering and construction, who will act as director of the project. Research will deal with the fundamental engineering properties of plastics and, if necessary, says W. Stuart Landes, president of PMMA, will set up new test methods, similar to those now available for other structural materials. Improved design for present uses of plastics, and more fields of application, should result from better understanding of their behavior, Mr. Landes pointed out.

While the purpose of the M.I.T. project is to correlate physical properties with chemical composition, none of the research is to be aimed at development of new plastics. According to the announcement, only plastics now in existence, or which will become commercially available, are to be studied, the results of such research to be published in scientific journals, with data made available for industrial laboratories of participating companies while the research is in progress.

The B. F. Goodrich Chemical Co., Cleveland, announces the availability of an 8-page reprint of an article on the company's newly-developed allyl-ester type resin, *Kriston,* which appeared in the December 1945 issue of ***plastics***.

The article describes *Kriston* monomers in detail, relates easy methods of fabrication, and points out its combination of electrical, mechanical and optical qualities which supply potentialities for applications in a wide field, either alone or with other materials in laminate form.

SPECIALISTS

INJECTION MOLDING

THE

GROTELITE CO.

INCORPORATED

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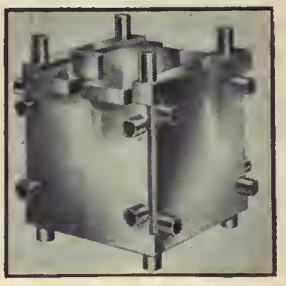
Drillet Box Jig Saves Up to 75% of Jig Body Expense and Labor!

The six-sided Drillet Box Jig above and at right has a range of 125 different sizes, making it possible to accommodate all sizes up to 6" capacity—for drilling, reaming, counter boring, counter sinking, spot facing, tapping, etc.

The Drillet Box Jig makes special tool design for drill jig unnecessary. Saves up to 75% of the time and cost of building a jig body. By merely turning thumbscrews and raising leaf, parts may be quickly loaded or unloaded. The jig may be used on all six sides, taking advantage of its full capacity.



Drillet Box Jig In Locked Position

Another useful product is chewing gum. You can enjoy chewing Wrigley's Spearmint Gum even while your hands are busy. The pleasant chewing helps to steady you—helps keep you alert and on your toes when you're doing a monotonous job.

Besides the satisfaction chewing gives you, it helps keep your mouth moist and fresh so you naturally feel better—and feeling better you work better.

Scores of industrial plants report that they have stepped up their workers' morale and efficiency by making chewing gum available to them.

You can get complete information from
The Chicago Drillet Corporation
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Plastic molds, master hobs, hobbed cavities and steel stamps . . . backed by our 36 year reputation for reliability, personal service and precision workmanship . . . your guarantee of complete satisfaction.

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PEOPLE

John J. Bachner, vice president of Chicago Molded Products Corp., has announced the appointment of **James E. Johnston** to the position of field sales manager in charge of all technical representatives of the company.

Also announced is the resignation of **Lee T. Bordner,** formerly district manager, who intends to establish himself as an independent manufacturers' agent in Los Angeles, representing various companies, including Chicago Molded Products Corp.

* * *

L. E. Osborne was recently named senior operating vice president of Westinghouse Electric Corp., and responsible to the president for all manufacturing units of the company.

* * *

Richard A. Loeb, on leave as Major with the U. S. Fifth Army, has returned to the presidency of Universal Plastics Corp., N. Y.

S. H. Thomas

H. A. Eggerss

J. W. Parks

Samuel H. Thomas has become New York district sales manager of General Electric Co.'s Chemical Dept., handling the area comprised of New York, Connecticut, and northern New Jersey.

* * *

Hans A. Eggerss has been elected executive vice president of Continental Can Co., Inc. A director of the company, and formerly vice president in charge of paper and plastics, Mr. Eggerss is also president of The Container Co., a subsidiary.

* * *

Joseph W. Parks has been appointed manager of the Plastics Division of Owens-Illinois Glass Co., and will handle the development of sales of plastics items other than closures.

* * *

National Starch Products, Inc., has announced that **S. F. ("Woody") Thune** has been made manager of the company's New England Division, with headquarters in Boston.

* * *

Announced by Barnes & Reinecke, designers and engineers, Chicago, are the following personnel appointments: **R. M. Fischer,** advertising manager; and **Harry Ankeney,** to the sales engineering staff. Both new appointees have had comprehensive experience in their respective fields.

* * *

Arthur R. Haley, general manager of the Columbia Cement Division of Pittsburgh Plate Glass Co., died at his home in Zanesville, O., on February 14.

* * *

Plastic Articles Co., New York, has announced the addition of **E. Bender,** formerly senior processing engineer at Bell Aircraft Corp., to its industrial design department.

* * *

Recently announced by Advance Pressure Castings, Inc., Brooklyn, N. Y., is appointment of **Alfred F. Gauron** as field engineer for the New England district, with headquarters at Amesbury, Mass.

* * *

Arthur Sevitt, managing director of International Electrical Industries, Belfast, Eire, is visiting the United States for the purpose of placing contracts in the field of "moldings for large

house furnishing commodities." His address in this country is given as 460 Beach 138th St., Bell Harbor, N. Y.

* * *

Frank G. Oswald has been made assistant sales director of the Synthetics Department of Hercules Powder Co.; **Malcolm C. Moore** is to manage a new group established by the department to handle the market development of new products, with **J. Glenn Little** as assistant manager.

* * *

Alex Tremulis, automobile and aircraft stylist, has recently joined the staff of Tammen & Denison, Inc., industrial designers and consulting engineers, Chicago, in the capacity of head stylist of the organization's transportation division.

* * *

Simon Askin, assistant secretary of Heyden Chemical Corp., was recently elected a director of American Plastics Corp.

* * *

Three appointments to the new Chemical Products Division of Goodyear Tire & Rubber Co. are those of **R. T. Hickox,** to plastics and coatings sales, Los Angeles; in the division's *Pliofilm* packaging sales department, **A. E. Grundy** to Los Angeles and **H. E. Williamson** to Madison, Wis.

* * *

Luther L. Yaeger has joined the staff of Bjorksten Laboratories, Chicago, as a research chemical engineer, in the plastics department.

* * *

Frank H. Smart, formerly with the plastics division, E. I. duPont de Nemours & Co., has joined the sales staff of Whittaker, Clark & Daniels, Inc., N. Y., where he will handle the company's general line of non-metallic minerals in the State, specializing in the plastics field.

* * *

Announcing expansion of its product line, introducing new chemicals and thermosetting resins, Wilmington Chemical Corp., N. Y., reports several additions to its technical sales organization: **Joseph M. Hoopes** will represent the company in the New England area; **Rolf G. Grote** will cover the territory from southern New Jersey to North Carolina; and **R. J. Davidson** is to handle the Canadian-Buffalo area.

H. R. Alley

L. S. Gilleo

L. L. McMaster, Jr.

* * *

Harold R. Alley has joined the Arvey Corp., Chicago, as director of research.

* * *

L. S. Gilleo has been appointed sales engineer representative for Dzus Fastener Co., for the Michigan-Ohio-Indiana territory, and **L. L. McMaster, Jr.,** for the Middle Atlantic states. They will provide engineering consultation service for plastics manufacturers using Dzus fasteners, in their respective territories.

* * *

Fred C. Walter, who has been associated with the sales, advertising and product development of The Formica Insulation Co. for a number of years, has been made assistant sales manager of the company.

Kenneth Pitt, until recently associated with the Formica home office and plant purchasing department, has become affiliated with Francis Murdock, Boston representative.

* * *

G. H. Gaites has been named district manager of the New York office of The Bristol Co.

Are you considering molding a part or all of your product in one of the many plastic materials? Are you not quite sure of the wisdom of such a procedure? Why not ask MARTINDELL, whose experience in this field covers an entire lifetime?

If the judgment is favorable to plastic molding, the MARTINDELL organization will be glad to take the job in hand. Results will prove the correctness of the decision.

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For over forty years we have been leaders in the design and manufacture of component parts for leading Refrigerator, Stove, Furniture, Appliance and Cabinet industries. We specialize in custom molding by the injection, compression or transfer method in any thermosetting or thermoplastic material. A complete service from one source to serve your needs — at no extra cost.

RESEARCH — Highly experienced research engineers to determine the material best suited for your needs as to strength, utility and beauty.

DESIGN — A thorough study is made as to the utility, shape and color of the plastic part that will best harmonize with the style and design of your product.

ENGINEERING— Here is where the correct tools, precision dies and molds are developed to produce the best job, efficiently and economically.

TOOL AND MOLD MAKING — This department, manned by expert craftsmen, makes the necessary tools and molds to produce the finished product.

MOLDING — A complete department equipped with the latest and most modern presses and molding equipment — for Injection, Compression or Transfer molding.

INSPECTION AND SHIPPING Each individual piece is carefully inspected for uniformity, color and finish. All parts are carefully wrapped and packed for utmost protection.

If you are planning the use of plastic parts in your products, it will be advantageous for you to investigate our complete service. Write or phone us about your needs.

NATIONAL LOCK COMPANY
Plastics Division
ROCKFORD, ILLINOIS

ENGINEERING — *News Letter* —

By LEWIS WINNER
Market Research Engineer

Waste Reclamation

The past few years have seen striking progress in the art o waste recovery. In the oil industry, we have learned how variety of base substances were made available by waste ma terial extraction. The perfume and chemical industries hav also capitalized on this interesting procedure for many year Recently, the plastics industry has initiated waste recover development programs. Substantial results have been recorde many vital materials having been produced for a variety o applications.

Unusual waste sources have been found. Processing of wast muck from distilled wash oil obtained from coke oven gas, fo instance, has resulted in a clear, red, brittle resin with propertie similar to those of synthetic indenecoumarone resins. This is a inert type of resin which is suitable for coatings and linings, an is able to withstand the action of acids, fruit juices and alcoholi beverages. The resins are also extremely resistant to ultra violet light.

The waste muck which supplies this interesting resin ha heretofore affected the processing of coke oven gas. Found i the gas passages, it has restricted the flow of gas and thus re duced the efficiency of light oil absorption. By means of this new recovery process, developed by Joseph H. Wells and Phillip J Wilson, Jr., of Pittsburgh, distilling of the waste muck in a vacuum still operating with a very high absolute pressure, with proper temperature control, provides separation of the wash oi and the resin. The wash oil appears in the distillate while th resin is found in the still kettle as a liquid. On cooling it hard ens to a solid form. Control of distillation conditions provide different melting points for the resin.

A temperature of about 250° C (482° F) provides polymeriza tion of the compounds from the gas.

Light Oil Recovery Process

The light oil recovery process, which provides this waste, i quite interesting in that it presents a cycle of operation that may be used as a basis of other waste recovery studies. In the removal of the light oil from the coke oven gas the gas is firs washed with a petroleum oil, known as a "wash oil." This ligh oil is then removed from the solvent by distilling the oil solution at about 100° C or more with direct steam. The ingredients o the light oil boil at temperatures below 200° C and provide a distillate. The wash oil, however, boils between 250° and 400° C, and remains in the still. The distilled wash oil is then returned to scrubbers and the cycle continues with continuous circulation of the wash oil. During this process the wash oi absorbs, from the gas, other constituents of gaseous and liquid and solid form. Much of this material consists of unsaturated compounds. These polymerize and combine with each other in a chain of complex reactions. Some of the resultant products are suspended as finely divided particles in the oil. Others are dissolved.

Because these particles do distill at relatively high tempera tures they do not come over with the light oil. Instead, they gradually accumulate in the wash oil. As the recirculation of the oil continues, these compounds precipitate and emulsify with water and dirt and then separate from the oil as a brown muck or waste.

This brown muck separates in all parts of the system, and is removed periodically and boiled with steam to separate and recover as much oil as possible. However, some waste muck remains and the problem of disposal has been quite a serious one Because of its high organic property, the muck is really a fire hazard. It is also difficult to control burning of the muck be cause of its water content and inconsistency of particle construc tion. In attempting to destroy the muck by burning, the waste has been found to plug the burners and clog the system.

Resin produced in one particular experiment had a melting

oint of 92° C, a specific gravity of 1.0, and an ash content of 09% by weight.

Combination Processing

Combination processing has recently proved quite effective in roviding highly practical plastics materials. Through use of his procedure it has been made possible to manufacture styrene om benzene and ethylene. The process developed by Wm. J. Mattox of Chicago provides for the alkylating of benzene and hen converting the resulting alkylation products into styrene. High yields of styrene are said to be possible from the complex roduct of benzene alkylation.

In the alkylation step, benzene is alkylated with ethylene, using catalyst such as phosphoric acid which has been combined with suitable siliceous support such as kieselguhr, and calcined.

The development provides for the use of lower ratios of enzene to ethylene in the alkylation step. This is so because it s no longer necessary to avoid the formation of polyethyl enzene. That is, both the monoethyl and polyethyl benzenes re converted to styrene in the second step of this process and he resultant ethylene and benzene are recycled for further onversion.

Another feature of the development is that substantially all of he material boiling below monoethyl benzene is recycled in art to the alkylation step and, in part, to the dealkylation-high chydrogenation step, and is eventually converted into styrene.

An ultimate yield of about 90 to 95% of styrene, based on the thylene charge, is said to be available with this process.

Lamination Strength

With the increased need for laminated plastics in products requiring higher strengths, many methods have been developed to ncrease lamination strength.

In preparing standard types of laminated materials, sheets of aper or layers of fabric are impregnated with synthetic resins. These impregnated sheets are then stacked and molded under ressure. It has been found that greater strength is obtained vhen resins, such as phenol formaldehyde, are reinforced with aper or fabric laminae, than when the resin is merely mixed with a fibrous filler such as cellulose pulp. The amino plastic resins, however, do not seem to provide increased strength when they are reinforced with paper or fabric laminae. As a matter of fact, the same mechanical strength is exhibited when these amino plastic resins are merely reinforced with cellulosic fibres which are not in a form of paper or fabric. The reinforcing effect of the cellulosic filler in fabricated form seems to be practically lost when it is associated with amino plastics.

Glass Cloth and Paper

To overcome this problem, Kurt E. Ripper of Bronxville, N. Y., has developed a process utilizing layers of fabric or paper, and one or more layers of glass cloth, and then bonding the combination with an amino plastics resin.

In one type of bonded sheet, paper and sheets of glass cloth .01" thick were impregnated with a melamine-modified dicyandiamide-formaldehyde resin syrup. The impregnated paper and glass cloth were dried and partially polymerized by placing in an oven heated to about 70° C for approximately half an hour. The glass cloth was placed horizontally because of the tendency of the resin syrup to run off the sheet in a vertical position. The impregnated paper contained about 55% of resin solids before pressing, while the glass cloth contained about 30% of resin solids before pressing.

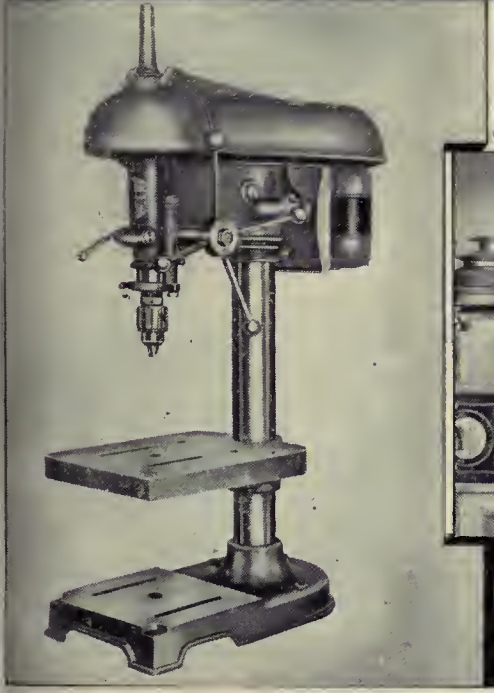
Impact strength was about 262 cm-kg/cm.

Canvas cloth and linen cloth may be substituted for paper, and glass cloth ranging in thickness from .002" to .015" has been used successfully.

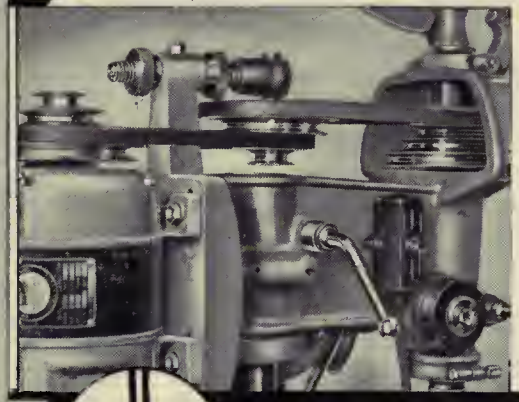
It has been found best to impregnate the glass cloth with a resin different from the impregnated resin which is used for the paper or fabric cloth. For instance, the glass cloth may be bonded with a dicyandiamide-formaldehyde resin, preferably modified with a minor proportion of melamine, while the paper or other fabric is impregnated with a melamine formaldehyde resin or urea formaldehyde resin.

The lamination process can be used for tubes and rods, as well as for mold shaping. END

The right drill speed is important..
The W-T 15" Drill Press with the Multi-SPEED Drive gives You 14 SPEEDS!



165 to 6750 R.P.M.



● This combination provides an exceptional speed range, with more than enough steps to drill all plastics at their optimum speeds.

The Walker-Turner 15" Drill Press is built for steady production—proved in tens of thousands of industrial setups. It has four in-line ball bearings, six-splined spindle, and sturdy construction.

Other Walker-Turner attachments which still further increase its usefulness are: Table raising mechanism; Head raising mechanism; and a precision machined Extension Arm for handling wide pieces.

Write for complete information.

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Plainfield New Jersey

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MACHINE TOOLS

DRILL PRESSES — HAND AND POWER FEED • RADIAL DRILLS
METAL-CUTTING BAND SAWS • POLISHING LATHES • FLEXIBLE SHAFT MACHINES
RADIAL CUT-OFF MACHINES FOR METAL • MOTORS • BELT & DISC SURFACERS

association activities

Conference of SPI Low-Pressure Industries Division

The first conference of the Low-Pressure Industries Division of the Society of the Plastics Industry, held at the Edgewater Beach Hotel, Chicago, February 1 and 2, reported attendance exceeding all expectations. The exhibit held as part of the two-day session displayed a variety of low-pressure molded and fabricated applications.

Featured speakers and their topics were: John D. Lincoln, Lincoln Industries, Inc., "Low Pressure Molding During t War and Its Possibilities in the Future;" Roy B. Anderso president, Wipe-On Corp., "Protective and Decorative Coatin and Finishing Systems," and methods of their application f low-pressure laminates and plastics molding materials; Phil L. Rhodes, naval architect, Cox & Stevens, Inc., "The Nav Architect Looks to Plastics;" William I. Beach, of the technic staff, Henry J. Kaiser Co., "Post-Forming Developments Du ing the War and Their Applications to Peace-time Products William J. Connelly, consumer relations division, Bakeli Corp., "Present Products in the Low-Pressure Molded Lam nates;" Egmont Arens, industrial designer, "Future Trends the Low-Pressure Field;" Dr. Preston Bradley, "The Wor in the Making."

Meeting Committee, SPI Low Pressure Industries Division Conference: C. L. Condit, J. E. Stokes, and Robert Brinkema

The committee in charge of arrangements was headed by J. Stokes, Bakelite Corp., who was chairman of the meeting com mittee, and Robert Brinkema, of Egmont Arens organizatio chairman of the promotion and display committee.

Officers of Pittsburgh Plastics Engineers

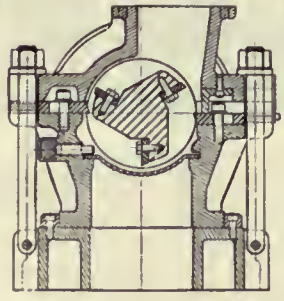
W. James Sharbaugh of the Mine Safety Appliances Co. w recently named president of the Pittsburgh Plastics Enginee Society, for 1946, by the Society's board of directors. In th office he succeeds Donald C. Lewis, of Mellon Institute, who n becomes vice president. Other executive officers are: W. Wilson, also of Mine Safety Appliances Co., secretary; and D. Munroe, Thompson Co., treasurer.

Detroit Plastics Organizations Meet

A joint dinner meeting of the Detroit Rubber & Plastic Group, Inc., and the Detroit Section of the Society of Plastic Engineers, was held at the Detroit-Leland Hotel on March 1. Speakers of the evening were Jay Southwell, sales engineer i the midwest territory, Bakelite Corp., and E. N. Cunninghan technical sales department, Staneo Distributors, Inc.

Dates scheduled for forthcoming meetings of the Detroit Rub ber & Plastics Group, during 1946, have been announced, as fol lows: Spring meeting, May 17; Fall meeting, October 18; an

Cumberland Plastics Granulating Machines



Compact cutting chamber provides a new degree of "INTENSIVE CUTTING"

Designed expressly for granulating plastic materials, Cumberland Plastics Granulating Machines provide exactly the type of "intensive" cutting needed for tough plastic materials. Compact cutting chamber; short, rugged knives; small cutting circle—these and numerous other features combine to give Cumberland Machines superior performance. Made in 4 sizes; No. ½ machine illustrated at right.

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istmas meeting, December 15. All are scheduled to be held he Detroit-Leland Hotel.

icago SPE Chapter Hears Convention Report

he Chicago chapter of the Society of the Plastics Industry, ting on March 3, received a report from William Hoey, ex- ive secretary, on the success of the SPE Convention in roit, and heard an outline of plans for the society for the ing year.

Villiam W. Broughton, manager of the die mold department, ional Lead Co., spoke on the subject of plastics molds.

he following members have been elected officers of the sec- for 1946: Jean O. Reinecke, president; E. Woodman, vice ident; Warren Cooper, secretary-treasurer; Charles C. ry, program chairman.

ew directors appointed are Ray Bauspies, Warren F. per, Jr., and William L. Hess.

atings Discussed by Plastics Club of U. S.

he March 12 meeting of the Plastics Club of the United es, held at the Hotel Pennsylvania, New York, was con- ed as a general forum, with Marian Cerf, of Plasticote Co., erson, N.J., in the rostrum. Miss Cerf answered questions n the floor concerning plastics coating on textiles, outlining development of this phase of the plastics industry to its ent stage, where emphasis is placed on attractively colored printed fabrics coated for lasting protection.

at Sealing Topic at SPI Meeting

eeting at the Edgewater Beach Hotel, Chicago, February he Mid-West Chapter of the Society of the Plastics Industry d a talk on "Heat Sealing Operations" by use of high fre- ncy electrical equipment, delivered by Wiley Wenger, sales neer, Radio Corp. of America, and "Vinyls for Heat Seal- " discussed by J. R. Price, division manager, thermoplastic sion, Bakelite Corp.

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Do not accept substitutes. There is only one plastic —CELLO-PLASTIC.

Now available in many beautiful colors and for every purpose.

Cello-plastic

Brings New Colorful Beauty and Durable Protection to FLOORS ★ WOODWORK ★ WALLS ★ EXTERIORS

Plastic is now prepared in liquid paint form for use in home, office, store, and factory. This has come about through the formulation of synthetic resins with specially processed oils combined with the finest paint pigments. A Cello-Plastic product is available for almost any type of finish or surface. Does not chip or crack!

BRILLIANT ★ SMOOTH ★ TOUGH ★ DURABLE

FOR FLOORS Cello-Plastic (transparent) is a *non-skid* plastic finish for all types of floors. This amazing new treatment gives floors a "cellophane-like" Plastic finish. Eliminates pores that absorb dirt, thus making floors easy to clean. Ideal for all surfaces including wood, concrete, linoleum, asphalt, tile rubber, composition, etc. *Eliminates waxing and polishing.* Unexcelled for marine use.

EXTERIOR This modern finish is a severely tested product that surpasses old fashioned type house paints. Pigmented with Titanium Dioxide, the whitest and best covering pigment, combined with kettle processed linseed oils and plastic resins, it makes a rich, colorful, lasting coating. Makes homes and buildings outstanding. For use on wood, stucco, brick or shingle.

INTERIOR Brings new glamour into homes—protect floors, woodwork, furniture, etc., with its long-lasting, "cellophane-like" Plastic finish. Easy to apply—flows smoothly—leaves no brush marks—self leveling.

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"S" Standard Chemical Dye.
"A" For Cellulose Acetate and Tenite.
"W" Dye used in Hot Water.

BLACK dye—applied in 15 min.—producing permanent ebony shade, available in all above.

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All intermixable, giving an unlimited variety of available shades meeting the most exacting requirements.

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Decorative Edgings

(*Continued from page 47*)

outside of New York City (all in the $250,000 or n class) which had received sample swatches and blow of the original publicity began receiving their first supp of stock.

The outstanding properties of the edging, as well as colors and types available, were pointed out in an advert ment of Macy's:

> *A new, wonderful trick with miracle plastic-film: made-up ruffled edging in gorgeous colors. Choose it single-ruffled in one gay shade, or double ruffled in two contrasting tones. Use it for shimmering durable shelf edging; for pretty trimming of aprons, shower curtains, dressing-table skirts. And remember: 1. It won't run or ravel! 2. It whisks clean with a damp cloth! 3. Good resistance to dirt and mildew! 4. It's non-inflammable.*

The manufacturer is already looking ahead to in ducing the all-plastics edging into new applications. Ne tiations are under way with a leading manufacturer of w en's sportswear, who plans to trim a smart bathing with *Trimcraft* edging. Its imperviousness to water sho make it an extremely durable addition to the suit, and beauty should prove to have great appeal. Applicatior lamp shades, aprons, and a dozen other items may also anticipated shortly.

Soon after its domestic exploitation has got a good st the company plans to devote some attention to the fore sale of its new edging. Stores in South America, Mex and South Africa, where the firm's edgings made of p ties-coated cloth are already known, will soon have st on hand.

SPI National Exposition

(*Continued from page 60*)

be gathered together at the Exposition, and will be availa to the manufacturer for consultation, for help to him in problems of production, design and engineering.

"Probably no Exposition held in the last decade will p vide such an immense fund of ideas for manufacturers w are keenly aware of the need for developing products w maximum utility, serviceability, and sales appeal to meet unprecedented competition that will characterize the Am ican economy when the great backlog of consumer dema has been met and business is again confronted with a buye market.

"The Exposition will in effect be a brilliant pageant this great new plastics industry. It will present the ba plastics materials, the machinery that fashions them i products, the methods and services for doing it, and t plastics products themselves—all together, under one ro all at one time. The manufacturer will be enabled, with t help of the industry's foremost technicians, to acquire formation and 'know-how' that would otherwise requ weeks of inquiry, tedious sifting of information. He w also be able to make direct comparison of the qualiti characteristics and specific functions of all the plastic m terials equipment, machinery and services."

The daily hours of the Exposition will be as follov Monday, April 22 and Tuesday, April 23, from 11 a.m. 10 p.m.; Wednesday, April 24, from 11 a.m. to 6 p.m Thursday, April 25 and Friday, April 26, from 11 a.m. 10 p.m.; and Saturday, April 27, from 11 a.m. to 6 p.m.

The Society of the Plastics Industry Conference, which

PROGRAM

SPI—1946 Conference

unday, April 21, 1946

00 to 6:00 Registration

Monday, April 22, 1946

00 to 6:00 Registration
:30 Pioneers Luncheon

uesday, April 23, 1946

00 to 6:00 Registration
:00 Group Meetings

UTTON DIVISION, Stanley Borel presiding

OMPRESSION MOLDING, Paul C. Tietz presiding

. M. Quackenbos, Jr., Bakelite Corp., "The Relation Between Impact & Flexural Tests for Molded Plastics"

has J. Smith, Bryant Electric Co., "High Speed Plunger Molding of Phenolics"

XTRUSION, Fred Petersen presiding

2:15 **Luncheon**, G. K. Scribner presiding

:30 Dr. W. J. Worboys, vice chairman British Plastics Federation, "Greetings from the British Plastics Industry"

:45 Major General Leslie R. Groves (tentative), "The Development of the Atomic Bomb"

:15 **Annual Business Meeting**
Committee Reports: Technical, N. J. Rakas; educational, Horton Spitzer; accounting, R. S. Oliver; public relations, John Sasso; report of the executive vice president, Wm. T. Cruse; report on election

3:00 **Afternoon Session**, Charles Breskin presiding; W. S. Landes, president PMMA, "The Material Supply Situation"

Wednesday, April 24, 1946

9:00 to 6:00 Registration

10:00 **Group Meetings**

INJECTION MOLDERS, Horace Gooch presiding

Morris Yellin, "The Molder's Obligation to His Customer"

Bert Cash, Celanese Plastics Corp., "Forticel"

Election of Permanent Injection Molders Division chairman

MACHINERY DIVISION, Charles F. Elmes presiding

FABRICATING DIVISION, Charles Hunton presiding

LOW PRESSURE INDUSTRIES DIVISION, W. Burdette Wilkins presiding

Herbert Simonds, consultant, "Resins and Their Requirements for the Low Pressure Industry"

R. A. Hoffer, E. I. du Pont de Nemours & Co., "Application of Low Density Core Materials"

John Avignone, M. A. Cumming & Co., Inc., and John J. Townsend, Frank Snedaker & Co., "Tooling and Production Methods for Low Pressure Reinforced Plastics"

2:30 **Afternoon Session**

Wiley Wenger, Radio Corp. of America, "Heat Sealing Thermoplastics"

Demonstration of "Electric Sewing" machine

2:50 Frank Carman, PMMA, "Massachusetts Institute of Technology Plastic Research Project"

3:10 C. C. Concannon, chief, Chemicals, Drug & Pharmaceutical Unit, U. S. Dept. of Commerce, "The Plastics Picture in South America"

3:40 Jack Stokes, Bakelike Corp., "Low Pressure Molding"

6:15 **Reception**

7:30 **Dinner**, N. O. Broderson presiding

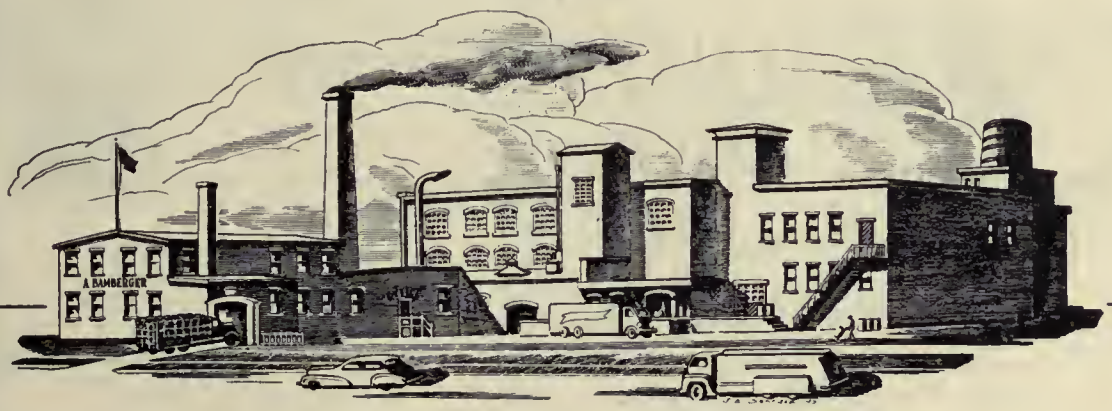
8:50 Hyatt Award Presentation, toastmaster, Dean Richard F. Bach

8:15 Address by Dr. Preston Bradley, Peoples Church, Chicago

9:45 Music by Fred Waring and his Pennsylvanians

Thursday, April 25, 1946

10:30 Accounting Meeting
Plastics Film, Unsupported Sheet & Fabric Division, F. J. Groten presiding
Address by Charles Dorn, J. C. Penney Co.



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being held in conjunction with the Exposition, will have headquarters in the Commodore Hotel, where its various meetings and functions are to be held.

Since the initial program of the Conference was arranged the Meeting Committee has extended the activities to include the morning of Thursday, April 25, with meetings scheduled as indicated in the accompanying program.

Chris Groos, of Boonton Molding Co., is chairman of the Meeting Committee.

plastics magazine will publish a daily, tabloid-size newspaper covering events at the Exposition and Conference. With a staff of ten or more, all events at the twin meetings will be covered for publication in the paper to be distributed to all delegates and guests the following morning. There will be a reporter on hand at all times at the magazine booth to take copy and prepare it for publication. Other reporters and editors will be at the Exposition and at the Conference, to assure complete and thorough coverage of the entire event. Distribution will be free, as a service to the industry.

ED

I Beg to Differ!

(*Continued from page 73*)

described in the article does contribute other important advantages which facilitate high speed molding. In the compression molding process, the charge must be loaded carefully and placed properly in each cavity. A slow close is required to insure entrapping the compound in the mold, and, in many cases, a breathing operation is also necessary to insure full gas relief. It is difficult to load quickly the multiple charges in a multiple cavity mold when high frequency preheat is used. Only one charge is necessary with the transfer mold since a common loading chamber is used and the mold itself performs the other function.

No slow close or breath is required and press speeds as high as 300" a minute are used. When the operator has loaded the single charge in the transfer chamber and manipulated the valve operating the transfer plunger, he is immediately free for other details such as the preparation of the next charge. Molds of this type equiped with automatic loading and unloading fixtures have been operated on 25 sec cycles using adequate preheat and high temperature molds.

High frequency preheating is a useful tool that will help the molders of the thermosetting materials. Full advantage is realized when used with an auxiliary ram or pressure type of transfer mold.

J. H. Du Bois,
Executive Engineer, Shaw Insulator

Cementing Phenolic Laminates

(*Continued from page 66*)

stating that these durable and reliable adhesives open up unlimited possibilities in the development of composite laminates. Unusual and attractive combinations of acrylic and laminated phenolics are among their number. Of course, either the acrylic or phenolic alone would serve many of these applications, though custom laminating of dissimilar components is likely to have great sales appeal to many designers and manufacturers. Where metals are concerned, however, a primer coat will still be required, as the furane resin does not possess a high specific adhesion to metals, though it does possess a remarkable adhesion to woods, plastics, and rubbers.

An unusual lamp which was designed and manufactured by C. K. Castaing combines acrylics and woods in a highly interesting and attractive manner. No attempt is made to conceal the glue line, the dark color of the furane being allowed to accentuate the combination. This unit has been produced at the Nu-World Plastics Company. Designs of

nature are distinctly original and reflect the unlimited r combinations possible. In other combinations, some ufacturers have found it economical to surface table prepared from low cost plywood or *Masonite* with a sheet of laminated phenolic. Once again the intimate bination produced through the furane resins proves ible.

ome of the characteristics of these adhesives which make sible the applications described in the paper may be ed. They are a room setting type, though higher tem- atures will naturally achieve the same result in a shorter e. The very high solids content of the adhesive—90 %— es it ideal as a gap filling medium, and there is no craz- or checking of large sections cast from this material. as matter of fact, considerable use for it has developed illing gaps on electrical equipment where exposed screw ds must be concealed for insulating purposes, the resin ming an integral part of the thermosetting structure.

t may also be interesting to record the results of a series year's tests just completed upon furane resin adhesives. nented assemblies of canvas-base laminated phenolic e placed at a temperature of 200° F continuously, except 4 or 5 shutdowns of 24 hours. The retention of shear ngth performance is still observable after one year's e. Likewise, samples of the material manufactured over months ago have been evaluated in their bonding ability n phenolics, showing no loss in strengths obtained and gelling tendencies which would nullify the usefulness of adhesive.

Adhesives of this nature are still to be considered as cialty adhesives, as they are not a panacea for all bond- problems. However, they do go a long way toward ablishing new and interesting assemblies of plastics terials. END

An Eye for An Eye

(Continued from page 29)

same time. This often requires a filling up of empty pockets in the orbit to eliminate them, instead of a duplication. The wax form is tested for proper contours by "palpation" with the fingers when the eye is inserted, as well as by direct inspection and comparison with the other eye.

Only plastics can satisfy the various individual requirements for a perfect fit. For one thing, the lids of both eyes must resemble each other. The area of the eyeball appearing between the lids (palpebral fissure) must be the same in both eyes. The artificial eye must not protrude or sink back into the orbit more than its mate, and the edge of the upper and lower lid must meet the iris at the same relative position. Finally, the prosthesis must be so positioned that when both eyes look straight ahead, the line of sight of each eye seems to converge to the same point; otherwise the eyes will appear cross-eyed or wall-eyed.

The chief objective is a realistic appearance when the eyes are looking straight ahead. At the same time, the artificial eye must move in synchrony with its mate to some extent. That is why it is important to take care that the insert is not so tight that mobility is prevented. Also, the relative lack of mobility can be partly concealed by turning the head rather than the eyes when the patient wishes to see something off at an angle.

The wax is easily shaped, being moldable at body temperature. Its final contours are modified by carving and finger-shaping. A circular recess is cut into the wax at the position marked for the reception of the iris button, which is seared in place. This so-called scleral form, with the protruding stem attached, is flasked in an artificial stone mold

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Giving the final polishing to the finished plastics eye

with its anterior surface toward the base. Heat is applie and the wax peeled out. The stem acts as a locator, markin the relative position of the iris button. The latter is r moved, and the entire mold is tin-foiled. The button is i serted again, and the mold is ready for the packing of th scleral plastics.

This consists of acrylic resin colored by permanent ine mineral pigments. Some 15 shades can be supplied t duplicate the brown, yellowish, or bluish color of the natura sclera.

The mold is closed, and the plastics cured in either boilin water for one hour or in dry heat at 100° C for three hour The stem is removed, and the flash that extrudes from be tween the two halves of the mold is eliminated. An overa polish of the cornea follows, particular attention being give to the limbus, which is not sharply cut as in glass eyes bu delicately modified to resemble that of a normal eye. Afte a smooth pumice finish, the eye is again tried out in th socket and alterations are made.

A special feature of the new process is the rich an delicate coloring of the sclera, as well as of the veins. I is this, in addition to the appearance of the iris and pupi which creates the uncanny effect of a living orb. The basi scleral shade is produced by zinc oxide, which gives a milk color. The subtle modifying hues are created by a suspen soid of permanent pigments in a 10% solution of acryli monomer and polymer. Brown, yellow, green, blue, an red are used for this purpose. These are blended care fully to duplicate the scleral appearance of the other eye Investigation has shown that the most nearly universa shade is a combination of green and yellow mixtures.

The sclera is then ready for the application of veins. Fo this purpose red hair-like rayon fibers (cellulose xanthate are employed. Nylon had been tried experimentally at first but it did not bond as well as rayon. After selection of th proper shade, a sample of the fiber is separated into delicat

ads of 5.5 denier called monofils, which represent individual veins.

hese monofils are brushed on the sclera with a mono-poly tion. After adhesion to the surface, the thread is read- corkscrewed into the tortuous and sinuous forms of real s by means of a pointed wooden applicator. The appear- of veins whose course is interrupted can be duplicated utting the monofils into short lengths. Red mono-poly be gently applied to simulate capillary beds with no nitc structurc. Other charateristic surface pigmentations also be achieved by touches of brown, yellow, blue, and n mono-poly solutions.

he final step is the forming of the conjunctiva, the nsparent outer coating that invests the entire eyeball. his process the button stem, removed while the sclera polished, is reinserted in its original position in the d, which is again tin-foiled. With the prosthesis in posi- in the posterior half of the mold, acrylic resin dough is le and thinned to the consistency of a wafer. This is ead over the anterior surface of the eye, and the flask is ed by spring pressure. Test packing is seldom necessary, curing is done at 100° C.

Application of the transparent plastics overlay to repre- t the conjunctiva is a delicate job, because if the closing ssure is too great or if the resin dough has not the proper sistency, the applied veins or surface pigments under- th might be scrubbed off, or crazing of the clear plastics he iris button might occur.

Final polishing of the artificial eye is done with arbor ds, pumice, tripoli, and other polishing agents. Only or adjustments are now needed, assuming that it has n carefully molded and tested by repeated insertions into socket.

The fitter must bear in mind that, to achieve perfect results, the eye must feel comfortable; there must be correct alignment; the corneal contour must be so molded that it reflects highlights in the same relative position and appearance as that of its mate and thus gives the illusion of a living eye. Final adjustment of the contours of the scleral form can be made only after the patient has worn it for some hours, as time is needed for the tissues of the socket to adapt themselves to the device.

What are the advantages of the all-plastics eye as compared with the glass eye? The latter can break, chip, or even explode while being worn, in which case bits of broken glass must be removed from the socket by an ophthalmologist. This risk is eliminated by the practically unbreakable and unchippable plastics. Also, fluids in the socket cause discoloration and etching of the glass surface, resulting in rough spots and discomfort to the wearer. These fluids have no effect on plastics.

Once the glass eye has been made, it cannot be changed or modified as the tissues in the socket change. The contours of plastics eyes, however, can be modified easily by sandpapering and polishing to make them conform to the changing requirements of the socket. This means an economic gain to the patient and also to the dealer, who must continually carry a large stock of various sizes and shapes of the glass variety. In case of injuries to the orbit of the eye, it is often impossible to fit the malformed socket with a glass eye based on standard curves. Only a custom-built plastics eye can be made to conform to the irregular contours.

There is little comparison between the illusion created by a glass eye and that of a plastics eye. The markings of the former are relatively crude, even in high quality products. The pupil is a black dot superimposed on the iris, and the veins of the sclera and iris markings are mechanically ir-

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regular. Rarely is it possible to obtain a perfect match wit the iris of the good eye. All these handicaps are eliminate in the plastics eye, a much more realistic three-dimension effect being created by the transparent iris disc suspende in clear resin and painted on both sides and also by the ap pearance of the scleral veins and the natural positionin of the pupil behind the iris.

Another point of superiority is in the comfort afforded b the material itself. Many patients can wear the all-plastic eye for as long as several weeks or even months witho having to remove it once. This is in line with experience reported at the Mayo Clinic, where methyl methacrylat has been used successfully in implants.

Mobility is another important point. In no case can th mobility of an artificial eye rival that of a living eyeba which is turned sharply in various directions by the con traction of attached muscles. The absence of these muscle in the artificial eye limits its movements to those produce by synchronous traction of muscle fibers in the socke Within these limitations, however, the plastics eye ha greater mobility than the glass eye because the thickness a well as contours of the scleral shell is aimed at optimu mobility, as well as comfort and esthetic effect. It w found, to mention one factor, that maximum mobility i attained when the posterior wall of the socket barely make contact with the posterior of the scleral form.

The plastics eye is impervious to heat, cold, and moisture It does not have an artificial, glassy look because, unlik glass, its outer surface does not have a high incidence o reflection. It is sensitive only to organic solvents lik chloroform and alcohol. Its only limitation is that i scratches more easily than glass. This, however, is not a serious handicap, since an eye is not normally exposed t abrasives. Hair-line scratches are scarcely discernible, an more serious ones are easily and cheaply removed by re polishing. It is significant that acrylic lenses are used i goggles to an increasing extent, and no serious scratchin problem has been reported.

Easier to Make Than Glass Eyes

A point of superiority in manufacture is the fact that the fabrication of an artificial glass eye requires special art and skill acquired by years of specialized training. Plastics, on the other hand, lends itself to routine technical procedures requiring a minimum of skill and laboratory equipment. It takes inexperienced technicians who join the staff of the plastics eye laboratories in the Army only a few months to become expert at their particular work, whether it is the coloring of the iris disc or the fitting of the wax form.

Another advantage is the availability of the basic acrylic resin used. Never again need there be dependence on a foreign country for artificial eyes. Finally, the plastics eye lends itself easily to molding, coloring, and adjustment to size and shape. It can be individualized to meet the particular requirements of the patient, unlike the standard glass eye. For this reason, each plastics eye furnished in the Army is given a number, so that fabricators can refer to the files and duplicate it in case of loss. Special markings not obtainable in the glass kind can be created in plastics, like the so-called "arcus senilis," the whitish circle sometimes seen around the edges of the iris in old people.

The all-plastics eye, as described above, is being made at this writing exclusively for the United States Army. The two largest optical companies in the country have expressed a strong interest in the processing and distributing rights. There can be little doubt that when the product is placed on the market for civilian use, its superior qualities will attract a steadily rising demand by the large army of one-eyed persons. Synthetic resin satisfies well the three factors important to the success of any prosthesis—namely, function, esthetics, and comfort. END

Notes On Commutator Design

(*Continued from page* 33)

sed with a moving contact arm, there are, of course, many inds of rotating commutators which have been made by ic same general method. The cylindrical commutator hown in Fig. 4 is an example of a metal-plated commutator hich would have been extremely difficult to make by ordiary assembly methods. Since the intricacy of the comutating surface does not affect the ease of plating, this articular job was reduced simply to the problem of mahining the plastics core, before plating.

A disc-type commutator was also made by the new nethod. In this, the commutating surface was on the circumference of the disc, and the plating was carried over to groove on each side to lock it firmly in place. The disc vas provided with an internal connector from the periphery o the hub, and after the commutating surface was mahined, two cuts were made, one on either side of this conector, to isolate this portion from the rest of the commuator. See Fig. 5.

In another application, where it was desired to generate type of electrical current known as a square wave, a disc vas similarly plated upon the periphery, and after the surface was finished, four cuts were made 90° apart to obtain four independent segments. However, in this case grooves were provided on the sides of the disc to connect pairs of adjacent segments together, and in the plating process, metal was also deposited in these grooves as the circumference was plated, to obtain the connections. In using this commutator, direct current is applied to two brushes diametrically opposite each other, and the square wave is

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obtained on another pair of brushes placed 90° away from the first pair.

Fig. 6 shows another disc type commutator application where many interruptions were desired per revolution. The circumference of the plastics disc was provided with depressions, and the plating was applied to the outer portion of the sides as well as to the circumference. After machining, alternate conducting and non-conducting areas were obtained, and the plating on the sides of the disc served not only to hold the segments in place, but also to connect all conducting segments electrically.

From the foregoing, it might justifiably be assumed that the metal-plating method of making commutators should be applied in all cases. Such is not necessarily the case. In order to deposit metal which has the necessary toughness and ductility, the rate of plating is generally held to about .001″ per hour. Therefore, it is seldom economically sound to plate commutators where the desired thickness of metal is greater than 1/32″. Furthermore, the edge of the plating cannot be exactly located where more than .002″ is used, because the plating takes place along the edge of the conductive area as well as upon it, thus causing the edge to "creep." This undesirable effect takes place more rapidly than might be expected, as the edge of plating does not benefit at all from the shielding of adjacent conductive areas. For the same reason there is always a tendency for the outer portions of larger surfaces to plate thicker than the central portions.

Shielding May Cause Trouble

Another effect which causes some difficulty is the shielding of depressed areas by the raised areas. Minimum metal is deposited at the intersection of the vertical and horizontal surfaces, so that as the metal builds up there is a tendency to form two separate pieces of metal, in intimate contact with each other, rather than one continuous piece. Then, after the surface is machined, a line appears at the junction of the two pieces. In extreme cases the plating may deposit in such a way that there is a gap which eventually bridges over as the plating continues, and if sufficient machining is required, the gap may appear on the commutating surface.

Where inserts are necessary, it is generally best to design them in such a manner that the plating becomes mechanically locked around them, since the operation of making the surface of the plastics conductive entails the chemical deposition of a thin coating of silver, and this coating acts as a

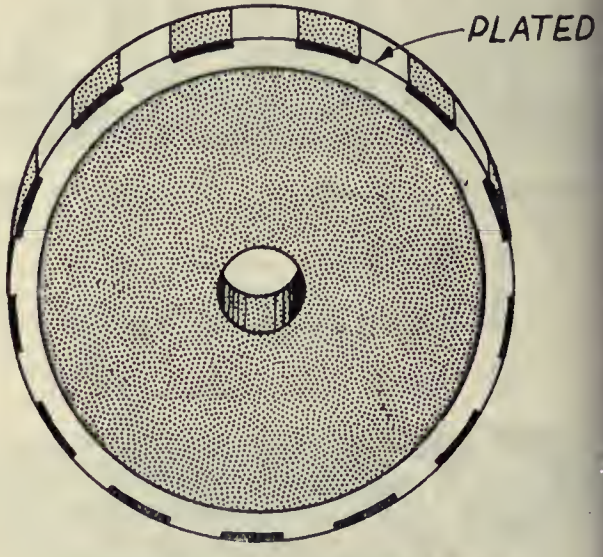

Fig. 6. Another disc type, with many breaks per revolution

barrier layer to decrease the adhesion of the plated metal to the insert.

As a general rule, when machining the plated metal, it is necessary to avoid overheating, and therefore this operation should be performed under a constant flow of coolant. The purpose of this precaution is two-fold. Since the temperature coefficients of plastics materials and metals are different, the differential expansion caused by overheating may cause the plastics-to-metal bond to fail in shear. Furthermore, it is seldom realized that metal plates with a good deal of internal stress. Overheating in the machining operation tends to relieve these stresses, and this may cause the metal to lift away from the plastics core. END

Plastics in Dentistry
(*Continued from page* 24)

tendency of the plastics to "check" (crack) the surface of teeth as it contracts tightly on the porcelain.

Again, the acrylics are subject to water-staining as a result of curing, and steps must be taken to avoid this. The methacrylates can be cured at relatively low temperatures. This obviates the necessity for a vulcanizer, but rapid transfer of heat to the interior of the flask is desirable.

In molding, the "case" (denture) is waxed in the usual manner, and the wax is tinfoiled. A bronze or copper heat conductor may be inserted in the plaster in the second half of the split flask to convey heat to all parts of the interior at the proper curing temperature. The exposed surfaces of all the posterior teeth may be painted with toluol solution to prevent the plastics from curing too quickly and tightly around the teeth.

The case is now ready for the plastics. If the monomer and polymer have to be mixed, this must be done in the right proportion as indicated by the manufacturer. The doughy mass soon stiffens. When the right degree of stiffness is attained, the flask is packed. Trial packing should be done with a sheet of cellophane interposed between the plastics and the upper half of the flask.

The flask is closed and processed in boiling water. This simple procedure is an advantage over the use of the vulcanizer, which involves extra equipment. It takes only 20 min to reach the boiling point and 45 min for the period of boiling. The case is cooled and opened and the denture finished in accordance with standard practices.

Another technique of molding developed in the last few years is the injector or casting method. In this process, an injector is used to force additional plastics into the single flask through a sprue channel. Instead of applying pressure on the walls of the flask in the split-flask method, the injector applies pressure directly against the packed plastics. Furthermore, continuous pressure is exerted during curing by compensating controlling springs which thereby overcome the usual curing shrinkage. This method is said by its advocates to remove all shrinkage and achieve greater density of the material, as well as complete elimination of porosity.

Widest Use in Dentures

While the acrylic resins find their widest application as base material for dentures, they are also being used to a limited extent for other applications. Acrylic teeth take the place of porcelain teeth. They can be made in various shades to match adjacent natural teeth with life-like fidelity.

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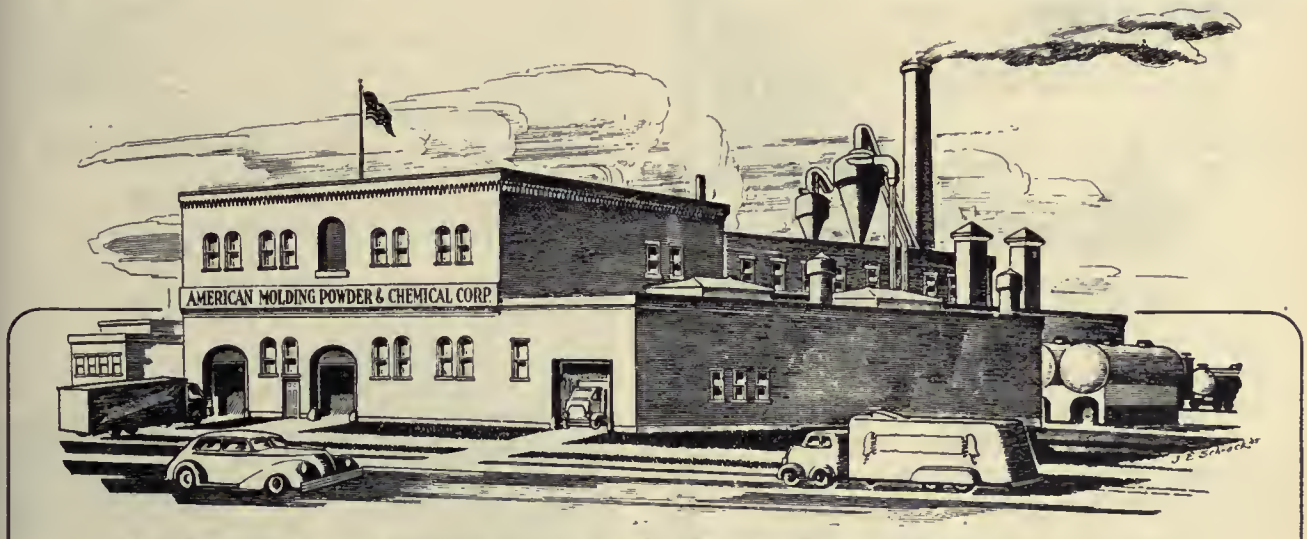

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lighter in weight than the porcelain kind. While dentists differ in opinion on their virtues, some dentists claim that, in some cases, they stand up better under pressure than porcelain. They can be easily and quickly replaced if necessary.

Acrylic teeth are now injection-molded for the most part. Some authorities claim that this avoids defects not detectable in compression molding, for this process makes it difficult to achieve absolute control over shade, blend, heat and pressure. This results in porosity and insufficient density. In the improved method, each tooth mold is automatically filled with the same amount of powder every time, insuring control of the shade. In addition, gradations of tone are controlled by mechanical blending.

Resistance to Surface Abrasion

Dentists who prefer porcelain to acrylic teeth express doubt of the durability and resistance to surface abrasion of the plastics. Some add that acrylic teeth warp after five or six months of constant wear or get loose or wear down as a result of attrition.

On the other hand, evidence of satisfactory hardness seems to be furnished by certain laboratory tests. One sample of acrylic tooth was subjected to 150 hr of continuous abrasive action under pressure from coarse pumice. The report claims that the tooth showed a loss of only 3/64″ in the vertical dimension. This abrasive action was equivalent to five years of denture use during the chewing of normal foods. Some advocates of acrylic teeth claim that the porcelain kind is subject to slight dimensional changes in the process of manufacture in contrast to the dimensional stability of the plastics.

The acrylics possess a certain resiliency which eliminates the click that results when two dentures meet, by absorbing the impact shock. That this can have important consequences is apparent from an anecdote told by a New York columnist recently. A certain stage star had been signed up for his first radio contract. When he made his debut, he was horrified to discover that the click of his denture, which had been hardly audible before, was magnified by the microphone to the point of almost ruining his act. A quick consultation with his dentist led to his being furnished with an acrylic set which eliminated his "static."

The methacrylates are used also for inlays, crowns and jacket restorations. An acrylic jacket crown fits snugly over the core of a decayed or cracked tooth. In texture and color, it can be made to blend realistically with that of adjacent teeth of the natural kind. A special triumph of dental plastics is the close fidelity to nature that can be achieved. Not only are different shades available, but the staining of the texture can be made to simulate with surprising naturalness that of various types of natural teeth.

Some dental technicians claim that porcelain teeth are preferable in full cases (upper and lower dentures), but that plastics teeth are superior for special purposes, for example, when the bite is very close or when the tooth to be replaced stands between natural teeth.

Acrylics Are Good Insulators

The acrylics serve excellently as thermal insulators, an important requirement in deep restorations. They are easy to prepare, finish and polish and can be repaired or modified without removal. Another important advantage of acrylics is their low specific gravity. They are widely used, also, in the making of "pontic" bridges, which are connected with inlays, the plastics being processed into metal forms designed to withstand stress.

As to inlays, authorities differ as to the virtues of plastics. One technician who uses the acrylics extensively believes that acrylic inlays are being "overused." He pointed

ut that gold is better for inlay work because of its superior ensile strength and marginal ridges.

On the other hand, some authorities maintain that acryl-cs are opening up a new field in "immediate" dentures. n this application, a mouth-impression is taken, *before* xtraction, of all the teeth. The denture is made up and eturned to the dentist, who then makes his extractions and nserts the plate which acts as a bandage to the gums op-rated on. When resorption takes place in the gums, any hanges in the plate required can be made by re-lining it.

ervice While You Wait

The use of plastics opens up the possibility of replace-ments while the patient waits. There are many cases where his is highly desirable. The acrylic resins, with their ease of manipulation, makes it feasible, not only to make im-mediate dentures but also to make repairs quickly on broken or faulty dentures.

The acrylics are also being applied in "relining" or alter-ng the denture base. It has been claimed that a re-basing echniquc developed a few years ago requires only 45 min o execute. Methacrylate resins are finding application in he preparation of obturators, surgical splints and similar ids.

During the war and to date the Dental Service of the Armed Forces has used 2½ million dentures, practically all of them acrylic. This does not mean full sets of teeth, of course, but any fixed bridges and jacket crowns, especially the latter, because they are much simpler to make in acry-lics than in baked porcelain. Fixed bridges could be made in the United States and sent out, but whenever they had to be made on the spot plastics were preferred. Acrylic jacket crowns wear down faster, at least in their present formula-tions, and the use of acrylics for fixed bridges and jacket

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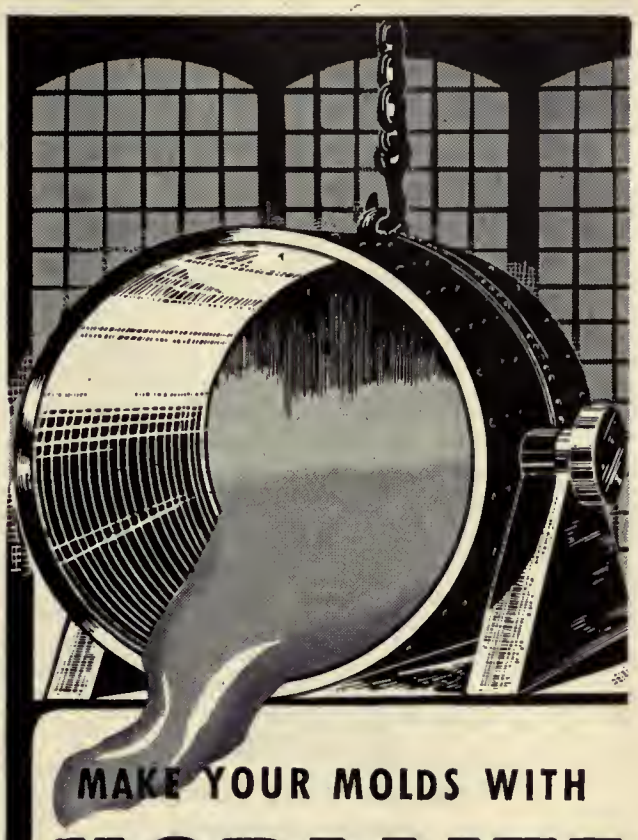

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Compress and flasks used in injection or casting method of dental molding. Pision presses on plastics in flask

crowns is not general in civilian practice. The Army too to acrylics because of the scarcity of rubber for denture but it turned out that the acrylics were actually more satisfactory. There has been little adverse criticism from th men in service. In a very few cases an allergy developed some men getting what they called a "hot mouth."

Not all dentists are convinced of the superiority of th acrylics in dental prostheses. Certainly, there is no possibility that plastics will entirely replace porcelain in th foreseeable future. For one thing, there have been impor tant improvements in recent years in porcelain teeth themselves. As far as denture bases are concerned, the metal are still superior to any plastics in one prime consideration strength and ruggedness. Acrylic dentures have been known to crack in the mouth. Some dentists claim that in the cas of full upper plates, occlusion may be off a trifle if the bas is plastics in spite of the care of the operator and that thi may lead to strain and breakage of the base. This hazard is entirely eliminated with metal.

According to one authority, acrylics are used extensively in full dentures. In partial dentures, the material may be gold or gold in combination with acrylic or acrylic alone. Obviously, the use of acrylics to take the place of gold means a great saving of money.

In spite of various objections to the acrylics, there is no question but that their role in dental practice has grown steadily in the past five years. One indication of their wide spread acceptance and popularity is the decline, estimated at 90%, in the use of the phenolic resins in this field, during the four years after the acrylics came on the market. Those in favor of plastics denture bases point out that the millions made since 1936 show a very small number of failures attributable to lack of strength.

In the dental field, the methyl methacrylate used is available under various trade names. Each concern uses its own coloring and shading. Besides the licensed, trademarked materials, many new kinds have appeared on the market which use various solvents instead of the monomer and are alleged to give good results in many cases, the cost being considerably lower than that of the licensed brands.

For all its virtues, methyl methacrylate has its limitations (chiefly, high moisture absorption and low strength com-

ared to metal), and this has spurred research into other lastics as candidates for dental purposes. Polyethylene, or example, is tougher and has less moisture absorption han the acrylics.

Among the new plastics denture materials is a modified inyl copolymer for which its manufacturers, Luxene, Inc., ew York, claim certain superiorities over the acrylics. It as less curing shrinkage (0.25 compared with 0.30 to 0.40 or the acrylics) and its impact strength is reported to be pproximately twice as great, according to tests made by hc American Society for Testing Materials. It has less noisture absorption, resulting in greater dimensional stabil-ty. This factor is important, as swelling may cause en-argement of acrylic dentures with subsequent loosening. t is claimed that the necessity for re-basing of the denture o correct this difficulty has been reduced to a minimum by he use of the vinyl material. In addition, it is not affected y contact with whiskey, as the acrylics are.

Vinyl dentures are made by a special pressure cast proc-ss which resembles transfer molding. A calibrated spring onnected with an indicator insures precise control of the ressure on the resin.

Many Differences of Opinion

Opinion varies widely in the profession regarding the uperiority of various materials. Some dentists even re-nain loyal to vulcanite, while those preferring plastics dif-er as to the best type. It is these differences that lead to ealthy competition and continual investigation of improve-ents both in materials and in processes.

The significant and overall point is that plastics have won permanent position in dental practice. One thing appears ertain: increased demand for dental materials in the future will mean increased demand for plastics, especially the crylic resins. Cost as well as satisfactory performance will be an important demand-factor: acrylic teeth cost about he same as porcelain teeth, but plastics dentures cost con-siderably less than the gold or non-precious metal kinds.

The great advance in denture development in the last 10 yr is indicated by the estimate of one dental technician that, out of 1,000 dentures, only one or two are made of vul-

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canite, the favorite material of dentists a generation ag Plastics alone or plastics in combination with metals, bot for full and partial dentures, will be, to an increasing ex tent, the material of the future in all dental laboratories.

Report on Dental Plastics in Germany

That the German use of plastics in dentistry followed line of development much like that in American dentistry indicated by the official report *Dental Education, Practic and Equipment in Germany,* by Lt. Col. George F. Jeffcot This report is the source from which the following para graphs have been abstracted.

The phenol-formaldehyde compounds, the cellulose n trates, the vinyl chlorides, the vinyl acetates, and othe resins have been tried and discarded, it is reported, until th acrylic resins have been left in practically sole possessio of the field. Acrylics were produced by various companie for denture bases, crown and inlay work, root canal point and temporary filling

Experimentation was conducted on the use of acryli resins for direct filling of teeth, with polymerization withi the cavity, until the Frankfurt plant and laboratory o Kulzer & Co., where the work was being done, was de stroyed in 1943. The material was not named, though it wa referred to as *Palapont S. H.,* the S. H. standing for "selt hardening." It was never marketed, but had been given t universities and individual dentists for testing. It was als tested on employees and officials of the firm.

This material had the same base as used for *Palapont,* plastics corresponding to American products for inlays an jacket crowns. It was modified only by the addition of a accelerator to the powder which reduced the setting tim ten to fifteen minutes. This accelerator was said to be tertiary amine. Use of an infra-red lamp to hasten settin was recommended but was not considered absolutely essen tial.

The material was used for all types of fillings, mos of them placed in 1943. The one filling examined by Col Jeffcott showed no signs of wear and the margins wer good. It was very poorly trimmed, however, and seeme to fill the approximal space, with considerable overhang It did not appear to have been placed with a matrix base in place though it was claimed that a matrix could be used The material was kept dry for ten minutes after being placed in the cavity but was not protected by varnish afte initial setting had taken place. The filling was trimme after fifteen minutes.

Also Used as a Cement

A novel application of the material was as a cement fo the placing of bridges and crowns. Used as the cementing medium for an acrylic jacket crown, for instance, it wa said to adhere so tightly to the tooth that it could scarcely be removed even after the jacket crown had been cut away and it sealed the margins of the jacket crown so that they could scarcely be detected. In cases where gold shell crown had worn through, they were simply removed and replace using acrylic self-hardening resin as cement, sealing th holes and giving very tenacious adhesion. The material wa also used to build up acrylic pontics in the mouth where porcelain pontics had fractured away. Cavity preparatio was not changed for this material. It was not thought t require any more bulk than silicate cement. Col. Jeffcot writes of seeing one distal-incisal filling on a left centra incisor which had been in place over two years.

In spite of successful clinical use of the material it wa not yet considered ready for market, nor have plans bee made to put it on sale until the Kulzer research laboratory can be reestablished and further experimentation carrie out. Two principal problems remain to be solved: (1) Shades are not permanent, and (2) there is some reason t

k that the material is irritating to dental pulp and leads ep cavities. Since *Palapont* has neither weakness, it is ved that the trouble is caused by the accelerator.

man Processing of Acrylics

he processing of acrylics in Germany varies in some ts from general practice in the U. S. At first, casts tin-foiled, but as vulcanization techniques were re- ed by boiling techniques, the use of any separating ium was gradually abandoned. Present practice is to t the cast and secondary investment, after boiling out, about three coats of 30% calcium chloride, allowing coat to sink into the plaster before adding the next . The calcium chloride is said to raise the boiling point. oisture within the flask to a point where no vapor is ned. Another material used is sodium silicate (water s), which also has been employed, with indifferent re- s, in the U. S. For use with vulcanizing, a material ed *Viton,* exact nature unknown, was used.

lastics teeth were found in common use, being, in fact, ost the only type available at the end of the war because he shortage of precious metals for pins. They were of l shades, and were well liked. All in all, plastics teeth duced in Germany were similar to those produced in the s.

ol. Jeffcott's final conclusions are that (1) no new basic tics for dental use have been discovered in Germany; new applications of plastics, probably known in the s., have been made for transparent base plates, tempor- filling material, and root canal points; and (3) results n experimentation with acrylic resin for direct filling of h justify the belief that this material may ultimately lant the admittedly unsatisfactory synthetic porcelain ents. END

SPE Convention and Exhibit

(*Continued from page 72*)

hod, and the dip and flow method. After the resin content been adjusted to the proper point, by any of the three coat- methods, the next operation involves the evaporation of the ent, which may be water, alcohol, or a combination of both. er the solvent is evaporated, the resin is condensed to a t where it will have the requisite molding properties for the at hand. Molding is the next step.

rincipal advantages of low pressure molding are the low d and tooling costs, even for the production of large fabri- ons. A disadvantage is the long cycle necessary in curing. n interesting development is a demand for a combination of nolic molding powders and phenolic-impregnated fabric, to duce a part having improved impact resistance over that sible by the use of compression powders alone.

a for Better Materials

he program continued with a paper on "Resin and Raw Ma- al Characteristics from a Laminator's Standpoint," by Dr. E. Perry, Westinghouse. The limitations of the raw materials d in laminates have been so acute that the composition of ually every laminate in production is the result of some kind compromise. The average laminator takes a staggering list fillers and proceeds to combine them with perhaps 25 or 30 erent varieties of resin or varnish, each with different char- eristics. The limitation of cost often becomes a deciding tor, the cost of filler ranging from three cents to three dollars ound and resins from twelve to fifty cents. Ordinarily lami- es are higher priced than the materials they displace, and must er some property which makes the net cost of the material er, or it undoubtedly will not become a permanent applica- n. (Refrigerator door liners, rayon spinning buckets, and ing gears were cited as successful or likely applications.)

Another application in which materials were very important s the low pressure laminate produced for plastics protective nor during the war. It was unique in that the property for ich the material was designed appeared to be the result of

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low bond strength, and the action in service might be tai controlled delamination.

It is certainly desirable that developments in fillers and r take the form of improved materials which will allow fo overall reduction in range and that the variety of properties existing may be concentrated in fewer end products.

Concluding the laminates symposium, R. J. Metzler, Herc Powder Company, spoke on "Thermoplastic Laminates." H pressure and low-pressure laminating processes, as they are erally known, both have the common factor of depending t thermosetting or polymerizing resins as the binder. Based t the specific resin used, each product in each field has its specific combination of properties, but since the binders are th dimensional polymers having low impact strengths, they r depend largely upon reinforcement for shock resistance. In the Hercules Powder Company re-opened an investigatio thermoplastic laminates based upon cellulose derivatives bec of (1) the industrial interest in low-pressure materials, (2) generally recognized high impact resistance of unreinforced lulose-derivative plastics, and (3) the excellent color and dec tive possibilities inherent in these materials. As work progres easy techniques were developed for deep drawing from flat sh without expensive or complex equipment. Therefore, engin and designers now have a new line of plastics materials v which to work.

Two methods were developed for laminating, one emplo the principle of shrinkage and called the wet or pressure pro the other using heat and 100 psi and called the low-pres process.

The cellulose-derivative plastics have always been recogn for their extreme toughness. As compared with the well-kn high impact strength of unreinforced cellulose-derivative plas lamination with fabrics generally doubles their strength. selecting special textiles such as glass, the impact strengt the base cellulosic can be tripled or in some cases quadrupled

Color possibilities, as in molded articles, are unlimited w the binder is based upon either cellulose acetate or ethyl cellul Printed textiles, for example, can be imbedded in a clear lami to create products of deep, lasting beauty. So broad are possibilities that a designer has no limitations on imagination decorative effects.

Another important feature of these materials is the ease v which finished articles can be fabricated. Heat-forming deep-drawing from flat sheets without complex or expen equipment is possible. Since these materials can be solv sealed or heat-sealed, operations such as drilling, punching, riveting are not usually required, although they can be d readily if desired.

Speaking on compression and transfer molds, B. F. Ha American Insulator Company, observed that the mold engi must not only know how to design a mold satisfactorily, must also be familiar with the five thousand-odd molding pow formulations that are available. In addition he must know type of steel to specify, and understand the design of inserts decorative inlays as well as the type of lacquers and paints apply to molded parts.

The very first step in making a mold, Mr. Hantz explain is to estimate the weight of the plastics by determining

Fred C. Conley (left), chairman of publicity committee, and Thomas E. Orr, general chairman for Annual Convention

er chairmen included John A. Mickey, head of speakers
mittee (left), and Richard Walsh, chairman of exhibits

he from the print or sketch supplied by the customer. The
eer also has to determine the number of cavities and the
of material to be used. Next, a hob, made from steel and
g the same general shape of the piece to be molded, is
ed into a block of soft steel or iron having a low carbon
nt. After the cavity is made, the outside surfaces are
ed off and finished and the plunger force that fits into the
is counter-milled and milled. Next the steam plates are
d. Following that, the molded parts are hardened in a hard-
furnace. The nearly finished cavity is then polished and
ted on a steam plate.

. Hantz concluded his talk with a discussion of the con-
tion and costs of different types of molds and also an analy-
top-ram transfer molding, which is said to eliminate waste.

irksite Plastic Molding Tools" was the subject of a talk
V. W. Broughton, National Lead Company. Kirksite, a
based alloy containing aluminum, copper, and magnesium, is
by every aircraft factory in the United States and Canada
one exception for sheet metal forming dies, he said, pointing
hat castings in plastics can be obtained with an accuracy of
two or three thousandths of an inch per foot. Although
material is not suitable for injection molding dies, a large
ntial field is low pressure molding, either with a rubber bag
with a solid punch and die. Another potential field is the
ing of toy automobiles in a one-cavity mold, for here the
of making a mold is very low. Some drawbacks of the
rial are its developing of slight surface cracks, low elastic
, and chemical reactivity to free acids in molding compounds.
hief advantage is its low cost.

ling Aspects of Cast Plastics

linton Rector, Catalin Corporation, had as his subject "Tool-
Aspects Of Cast Plastics." He discussed several of the
us types of plastics which have been developed for tooling,
icularly in the aircraft industry, and declared that, although
part cast plastics are to play in tooling in the future is not
lly clear, they are very likely to be used for limited produc-
runs and other specialized uses, especially for very large
s.

n his talk on "Plastics As Coatings," P. F. Corbin, Textile
her Corporation, pointed out that there are six general types
oatings applied to cloth, namely: cellulose ester, vinyl resins,
coatings, oil in resin coatings, starch and casein, and rubber
synthetic rubber; and that there are four common methods
pplying the coatings to cloth—by spreader, or doctor knife;
ndering; dipping; and rolling. The first step in the sequence
perations in coating with nitrocellulose, as Mr. Corbin gave
m, was the grinding of the pigments in castor oil. The three
redients—pigment, plasticizer, and resins—constitute the coat-
dope. While the dope is prepared, the base textile is usually
d and then dried under tension. The next step is the appli-
on of the dope to the fabric. After this, the cloth goes to
intermediate inspection and is then embossed.

Also discussed were compositions and methods of applications
the vinyl copolymers together with a description of pigments,
sticizers, and coating machines.

David S. Plumb, Monsanto Chemical Company, spoke about
olyvinyl Butyral Coatings." An interesting fact he noted

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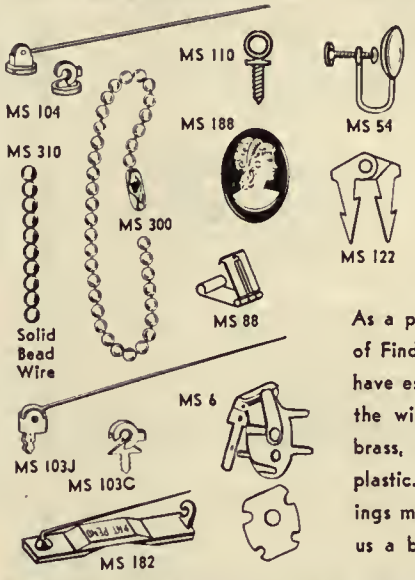

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INDEX OF Advertisers

April 1946

Advertiser	Advertising Agency	Page
Aaron Machinery Co.		106
American Flange & Mfg. Co., Inc.	Freiwald & Coleman Advertising	9
American Hard Rubber Company	E. T. Howard Company	80
American Molding Powder & Chemical Corp.	Lee-Murray, Advertising	99
American Phanolic Corporation	Burton Browne Advertising Agency	65
Amos Molded Plastics	Sidener and Van Riper, Inc.	20
Anigraphic Process, Inc.		105
Arrow Plastics Company	The Powered Company	103
Bambergar, A.	Lee-Murray, Advertising	91
Barnes & Reinecke	Behal & Baldie & Briggs Advg.	81
Battalen, L. H.	Gunn-Mears Advertising Agency	104
Blaisdell Pencil Company	Richard A. Foley Agency, Inc.	109
Boonton Molding Company	A. J. Slomanson Associates, Inc.	12
Bortman Plastics Company	Lawrence F. Dutton	79
Brilhart, Arnold, Ltd.	Henri La Mothe Agency	4th Cover
Cardinal Chemical Company	Feldman, Lafler, Inc.	106
Catalin Corporation	Walter J. Gallagher, Advg., 2nd Cover	
Celanese Plastics Corporation	Ivay & Ellington, Inc.	27
Celluplastic Corporation	M. C. Diedrich Advertising	48
Calle-Plastic Chemical Co.	H. M. Dittman Advertising	89
Chicago Molded Products Corp.	Almon Brooks Wildar, Inc.	74
Ciba Products Corp.	Cory Snow, Inc.	95
Continental Can Company, Inc.	Batten, Barton, Durstine & Osborn, Inc.	36
Continental Plastics Corporation	Jim Duffy Comoany	78
Cumberland Engineering Co.	Richard Thorndike	88
Despatch Oven Company	Haroid C. Walker, Advertising	96
Detroit Macoid Corporation	Walter J. Gallaghar, Advertising	63
Detroit Matariais Engineering Co.		104
Dickten & Masch Mfg. Co.		101
Dow Chemical Company, The	MacManus, John & Adams, Inc.	13
Dry and Company		106
Duall Molding Corp.	Gunn-Mears Advertising Agency	106
Durite Plastics Incorporated	Lawrenca I. Everting	15
Ekstrom, Carlson & Co.	Cummings, Brand & McPherson, Advg.	104
Emaloid Co., Inc., The	United Advertising Agency	7
Engineering Specialties Corp.	Maxon, Inc.	97
Federal Telephone and Radio Corp.	Rickard & Company	51
Feisenthal, G., & Sons	Lieber Advertising Co.	73
Gemloid Corporation	Gunn-Mears Advertising Agency	77
General Electric Co.	Benton & Bowles, Inc.	39
General Industries Company, The	Fuller & Smith & Ross, Inc.	16, 17
Gering Products, Inc.	M. C. Diadrich	93
Girdler Corporation, The	Roche, Williams & Cleary, Inc.	11
Gits Molding Corporation	Merchandising Advertisars	82
Goodrich, B. F., Chemical Co.	Griswold-Eshleman Co., The	5
Gorski Brothers		76
Great American Color Company		96
Grotelite Co., Inc., The	S. C. Baer Company, The	83
Hydraulic Press Mfg. Co., The	Jay H. Maish Company, The	3
Ideal Industries, Inc.	Van Auken & Ragland	92
Industrial Molded Products Co.	Wesley E. Sharer & Associates	14
Karistad, Andrew C.		
Kingsley Gold Stamping Machina Co.	Continental Advertising Service	
Kirk, F. J., Molding Co.	Cory Snow, Inc.	
Kreiger Color & Chemical Co.	Warran P. Fehlman Adv. Co.	
Kuhn & Jacob Molding & Tool Co.	Eldridge-Northrop, Inc.	
Kurz-Kasch, Inc.	Kircher, Helton & Collett	
Lester-Phoanix, Inc.	Gregory Advertising, Inc.	
Mack Molding Company, Inc.	Georga Homer Martin	
Magnetic Plastics Company, The	Gragory Advertising, Inc.	
Martindell Molding Co.	Eldridga-Northrop, Inc.	
Mills, Elmar E., Corporation	Jacobs Company, Inc., The	
Mosinee Paper Mills Company	Klau-Van Pietersom-Dunlap Assos., Inc	
National Lock Company	L. W. Ramsey Advertising Agency, The	
National Organ Supply Co.	P. W. Prica Advertising	
National Plastic Products Co., The	Joseph A. Wilnar Company, The	
Nicholl Hard Chrome Service		
Northern Industrial Chemical Co.	Callaway Associates, Tha	
Owens-Corning Fibergias Corp.	Fuller & Smith & Ross, Inc	
Paarson Advertising Agency, Inc.		
Pannsylvania Coal Products Co.	Lee-Murray, Advertising	
Plaskon Division, Libbey-Owens-Ford Glass Company	Meldrum & Fewsmith Advertising	
Plastics Exhibitors, Inc.		
Plastic Mold Engineaaring Co.		
Plastics Servica Engineering		
Pracision Design Service		
Presqua Isle Plastics, Inc.		
Radio Raceptor Company, Inc.	John A. Finneran	
R E C Mfg. Corporation	Cory Snow, Inc.	
Rohm & Haas Company	Newell-Emmett Company	
Siegel, M. B., Associates		
Sillcocks-Miller Co., The	Fred H Eversold, Inc.	
Sossner	Ehrlich & Neuwirth	
Stekert, Martin M.	Walter W. Wiley Advertising	
Stevenson, H. N., Jr.		
Stokes, F. J., Machine Company	McLain Organization, Incorporated	
Tarbonis Company, Tha	L. G. Maison & Co.	
Tannassaa Eastman Corporation	Kenyon & Eckhardt, Inc.	
Taxon Industrial Corp.		
Universal Hydraulic Machinary Co.	Gunn-Mears Advertising Agency	
Universal Plastics Corp.	Cayton, Inc.	
Universal Tumbling Compounds Company		
Walker-Turner Company, Inc.	Thoma & Gill	
Wall Street Journal, Tha.	Maxon, Inc.	
Waterbury Companias, Inc.	Manternach, Inc.	
Western Shada Cioth Co., Tha	Hardy Advertising	
Worcester Moulded Plastics Co.	C. Jerry Soaulding, Inc.	Third Cov
Wrigley, Wm., Jr., Company	Ruthrauff & Ryan, Inc.	
Ziv Steel & Wire Co.	Varnon S. Weiler Advertising	

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FOR SALE: Two new #4 Racine pumps var. vol. aut. gov.; one #8 gauge; one 1¼" pilot check, iov-76-AK; one sequence valve; one Racine 6:1 booster. Adv. Nov. Mfg. Co., 2218 N. Park Ave., Phila. 32, Pa. Fremont 4395.

but this plastics is that it may be rendered thermosetting in a process similar to the vulcanization of rubber. It may be coated any of the standard types of coating machines, Mr. Plumb clared, and for coating textiles a solid stock can be calendered rectly on to fabric. Solutions in solvent can be spread with standard rubber type knife spreaders, pyroxolin type spread-, saturators, or roll coaters. The resin is naturally adhesive l has no corrosive properties. Plasticizers required for its use quite cheap, and when the coating is applied to fabrics it parts a notable softness of "hand". In conclusion Mr. Plumb cussed the use of butyral coatings for upholstering, tablecloths, ggage, shoe fabrics, packaging, and other miscellaneous appli-ions.

"Metal Plating Over Plastics" was the subject of a talk by T. Marx, Monroe Auto Equipment Company. Mr. Marx dis-ssed the advantages obtainable with metal plated plastics in pect to electrical conductivity, weight, heat resistance, corro-n resistance, and decorative and color possibilities, and stated t the plating reduces certain undesirable features of plastics, ch as poor dimensional stability and low impact and tensile ength. The four general methods of metallizing plastics—tal spraying, vacuum deposition by evaporation and cathode ttering, and metal reduction, which from a production stand-nt is probably the most desirable method, were described. He ncluded with a discussion of the sequence of operations in plat-plastics by the metal reduction method and also noted that sign factors may be modified to improve plating procedure.

Metal and Plastics Make a Good Team

In his paper on "Plastics Coatings For Metals," Dr. Thomas ll, Aluminum Company of America, set forth the thesis that tal and plastics may team up to solve many problems that not be solved with either material alone. He discussed a mber of combined applications in support of this thesis.

Reporting the results of an original research in "Stability of enol Formaldehyde Plastics," F. A. Martin, The Hoover mpany, found that at 85% relative humidity molded phenolics ll absorb sufficient water to cause appreciable changes in nensions and weight. An equilibrium condition is eventually ached, and the amount of swelling or growth is dependent on the relative humidity and the type of filler. However, Mr. rtin also found that these changes are reversible by heat treat-nt, and that moisture absorption does not take place to any preciable extent at 50% relative humidity so that there is le danger of deterioration under atmospheric conditions gener-y prevailing in heated factories or laboratories. It is only at her humidities, the research indicated, that water absorption a factor to be considered.

Speaking on "Consumer Specifications and Their Applica-ns," G. F. Clark, Owens-Illinois Glass Company, pointed out t a company which is a supplier in relation to one customer y be a consumer of some other company's product, and that ch consumer in this broad sense must have his own specifica-ns. With reference to an automobile timing gear, for example, showed that the automobile manufacturer sets specifications hich he passes on to the molder, who in turn arranges with e material manufacturer for desired properties in the molding lder. Mr. Clark cited numerous other examples of this inter-lationship of factors in the plastics industry and its customers.

"Product Design From A Molder's Viewpoint" was the sub-ct of a talk delivered by C. C. Henry, Chicago Die Mold Manu-cturing Co. On the basis of his experience with several thou-nd compression and injection molded plastics parts, Mr. Henry ncluded that the average quality of product design had im-oved markedly in the past seven years. He laid stress on the e of accurately detailed models before proceeding with produc-n, pointing out that in one case $15,000 had been spent on oling a camera without such a model, with the result that e item was discarded after a scant dozen were produced. Mr. enry decried the practice of dimensioning designs from the sh line since that point often is relatively unimportant so far design features are concerned.

John Sasso, Managing Editor, *Product Engineering*, stressed e fact that the SPE, as a professional group, should recommend ndards of practice and collect and publish data on specific de-n practices as soon as they are available.

A talk delivered by Mr. N. Rakas, Chrysler Corporation, on e subject of "Industrial Aspects of Consumer Specifications" s not available for publication. END

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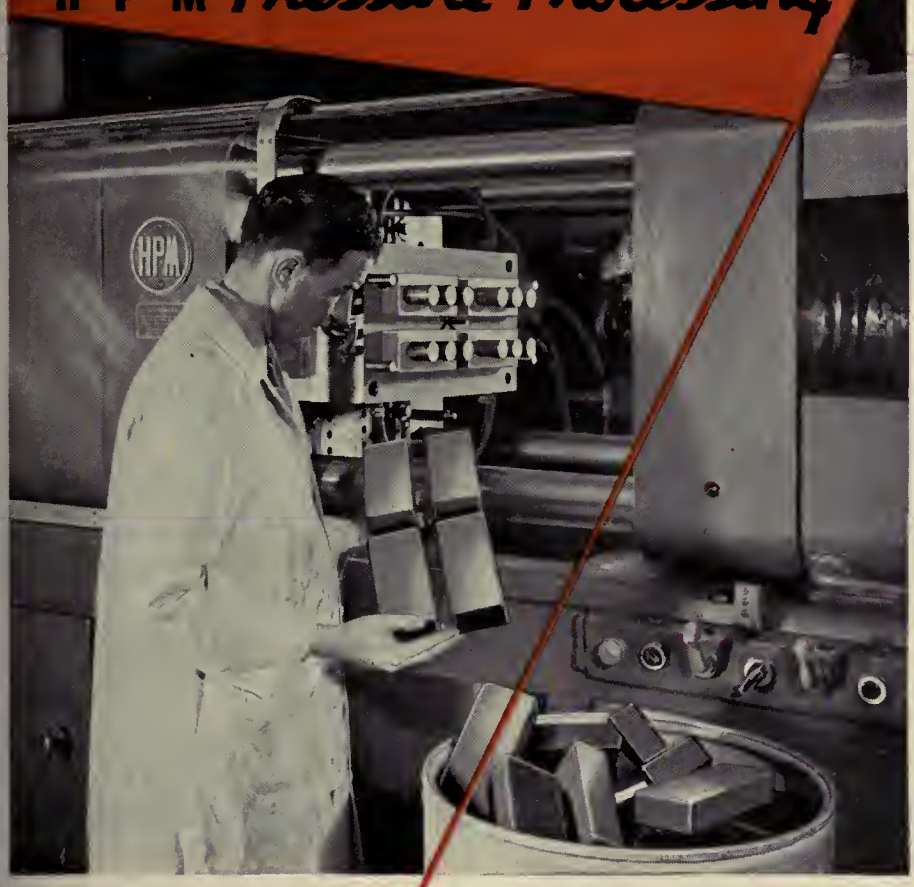

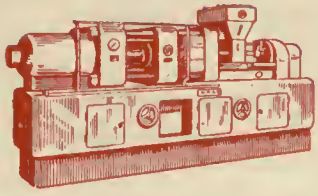

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MAY, 1946

plastics

VOLUME 4, NUMBER 5

in this issue

Plastics for Precision Lenses ..... *Philip Pollack* 27

Plastics Glazing Returns to Civilian Uses..... *Frank C. Williams* 32

Jewels for the Molding..... 37

Plastics in Toyland..... 40

Housing Looks to Plastics..... *Jack D. Stratton* 48

An Interpretative Survey of German Plastics Fabrication, Part II... ..... *W. C. Goggin* 54

How to Resin Seal Porous Metal Castings..... *Prescott C. Fuller* 58

Wall Covering That Can "Take It"..... 64

Injection Mold Design, Part I..... *John G. Robb* 68

Hobbing Ideas..... 76

The Package Sells the Product..... *Percy Barker* 78

departments

Plastics in Perspective..... 24

On the Drafting Board..... 53

Plastics at Work..... 66

What's New in Plastics..... 88

Literature Review..... 90

Statistical Data..... 92

Plastics Overseas..... 94

Problems in Plastics..... 96

Industry Highlights..... 97

People 99

Association Activities.....100

Engineering News Letter.....101

The Plastics Library.....103

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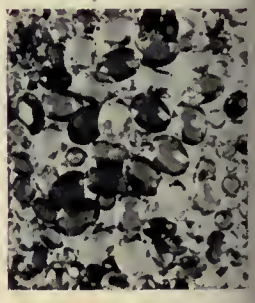

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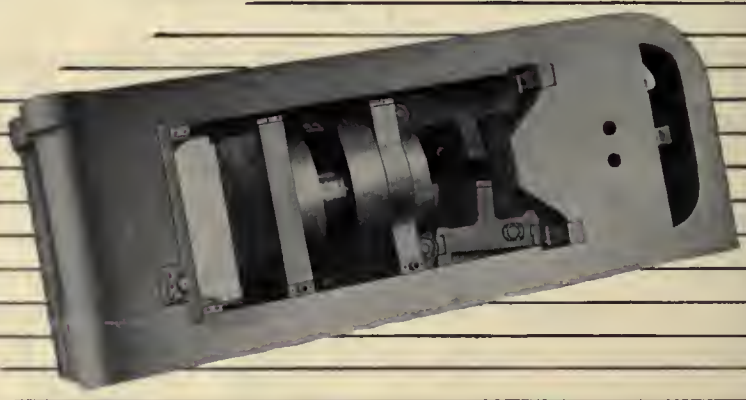

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WITH

Molded Plastics

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For information regarding applications of PENACOLITE adhesives to your process, write Pennsylvania Coal Products Company. Details covering intended uses, materials to be treated, and production methods will enable us to suggest the PENACOLITE best suited to your purpose.

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Microscopic scrutiny would reveal such imperfections penetrating far below the surface or finish, delving into the body of the structure itself. That's why experience goes a long way in plastic molding to obtain proper results . . . with mold making tending toward craftsmanship, rather than a mere mechanical phase.

WRITE FOR THIS INFORMATIVE BROCHURE

MACK MOLDING—With a background of some twenty-six years in serving industry—offers complete collaboration from design and blueprint inception, right through to final delivery. For a better, closer customer-molder understanding of plastic molding and the problems involved, an eight-page booklet is available on request. A general, non-technical treatise, this literature offers helpful hints and possibilities for plastics in your scheme of things. A note on your letterhead will bring your copy promptly.

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rot,

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These characteristics give Saran braid first call for hundreds of applications. Saran braid is new, but it's proving a big advance in wire protection —in simple jobs like telephone and extension cords and in complex radio and radar installations.

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Saran braid protects wiring against oil, moisture and temperature extremes.

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All of the facilities you require for the production of complete plastics and metal-plastics products are here at Lance . . . under one roof, with no "remote control."

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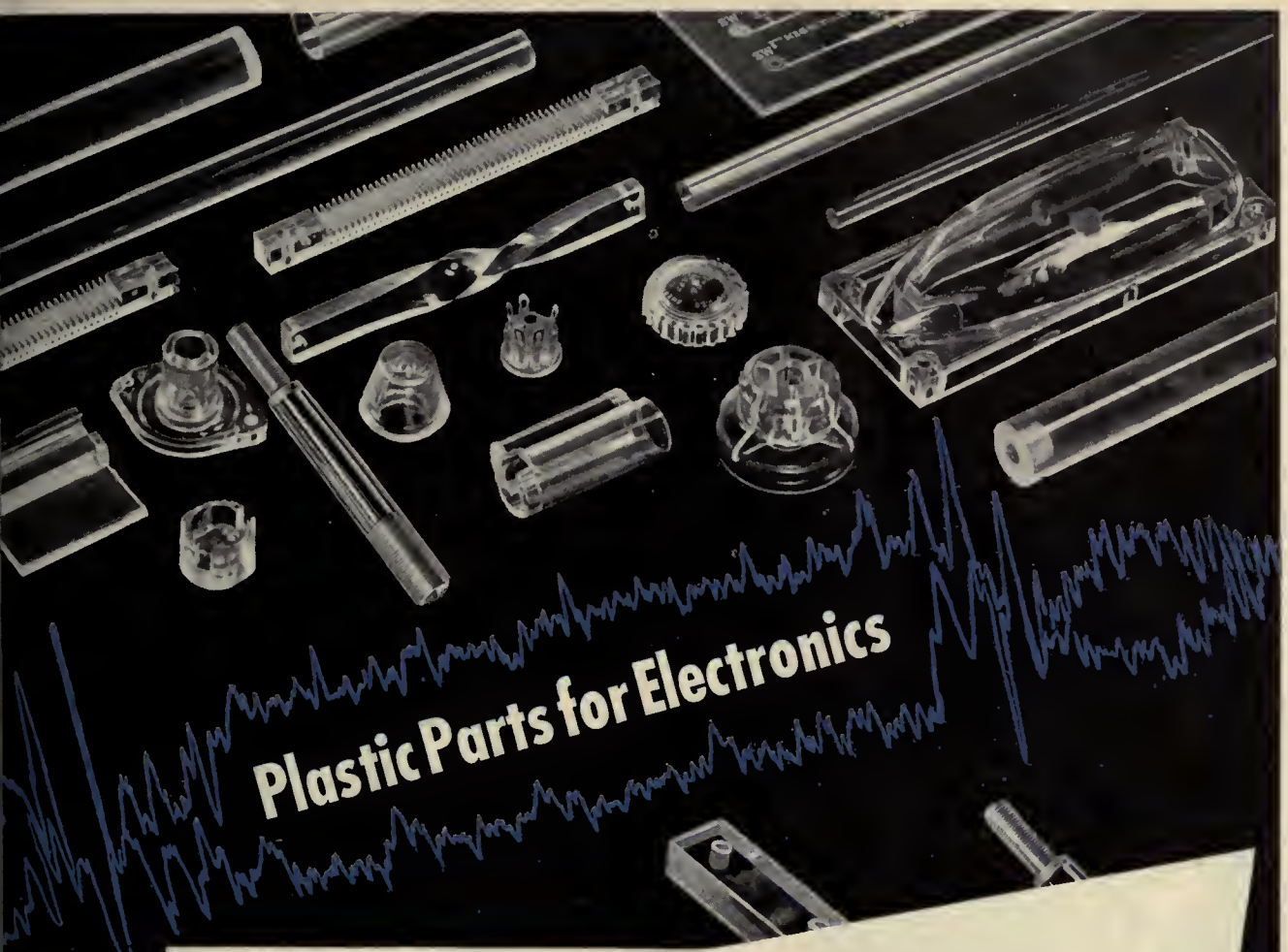

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In your product planning, the advice of our technical service staff may indicate how and where you can use plastics most effectively. The war experience of Celanese plastics can give you new insight into what these materials can do in improving products and reducing costs. Celanese Plastics Corporation, a division of Celanese Corporation of America, 180 Madison Avenue, New York 16, N. Y. *Reg. U.S. Pat. Off.

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PLASTICS in PERSPECTIVE.....

THE editorials in one of Chicago's leading morning newspapers customarily remind us of a man in a blind fury flailing his arms about wildly and lashing out frenziedly in all directions, so eager to injure his foe that he will not scruple to strike a friend who happens to be in the way. At other times we are reminded of an outlaw horse which bears such an irreconcilable grudge against the world that it is never so happy as when it can kick at anyone or anything which ventures within its range. Even so, we were hardly prepared for the below-the-belt punch we recently received as we read an editorial about Harold Ickes.

The editorial got under way characteristically. "If Mr. Ickes' cantankerous retirement from the cabinet . . . has any significance, it is as the opening gun of Henry Wallace's campaign for the Democratic nomination and the presidency," the writer began, in the process of working himself up into a "fine frenzy." He went on to get in some telling stabs at Truman, Pauley, Wallace, Biddle, Dewey, and two dead men—Roosevelt and Willkie. It must have required unusual restraint not to mention England and the proposed loan.

Despite the fact that we knew no one or nothing was safe when the "slings and arrows" began to fly, we could hardly believe our eyes when we came to this sentence, which not only delivered several body blows to Mr. Ickes but hit plastics a wallop: "He was in character to the last, vituperative, inspired by the sense of his own virtually unique integrity, and underneath it all as phony as a plastics sink strainer."

We had heard—and read—before of plastics items being criticized; in fact, we had indulged in some vociferous complaint on our own part when, the very first time we used a fine-toothed plastics comb purchased at a dime store, the teeth bent over and gouged us ungently in the head. But the newspaper attack struck us as being most unprovoked, representing the kind of flailing which we spoke of above. Also the word *phony* mystified us and still does. We believe that a reasoned criticism would have resulted in a more specific, meaningful, and accurate word, granting that the writer had a justification for his attitude.

The plastics industry, we believe, can take criticism; and criticism, we think, is good for it. But that criticism should be on a rational basis, not the by-product of a fierce and violently emotional spasm of a man who sees everything about him in the fiery glow of a long-nurtured political obsession.

* * *

IT IS surprising how quickly the end of one year is followed by the end of the first quarter of the next, and so on, This is merely another way of saying that the first quarter of 1946 (the first third by the time this appears in print) is history, and that the materials situation, generally expected some months ago to be at the very least slightly relieved, appears worse than ever. The reasons for the scarcities are most baffling, perhaps because they are probably almost as numerous as the scarcities themselves.

Various explanations suggested by persons plagued by the shortages, as well as by those not directly concerned, are slowness in building materials delivery thereby holding up new construction; delays in manufacture and shipment of additional processing equipment; strikes and labor shortages; increased molding capacities leading to unprecedented demands for molding powders; causes stemming from troubles in allied industries; and so on and on.

Regardless of the real explanation lying in the welter of possible causes, the situation is grave; and if one is to believe not merely the pessimists but the molders and fabricators who are not given to singing the blues, it is likely to get worse before it gets better. Dislocations in the industry due to scarcities—reputedly approaching the danger point for many companies—can be checked and eventually alleviated only by a record production of materials.

It is no exaggeration to say that the materials manufacturers in the next six months will determine to a great extent the immediate fate of important segments of the plastics industry. By working just a little harder, by producing just a little more than seems humanly or mechanically possible, the materials manufacturers can earn the undying gratitude of the rest of the plastics industry.

* * *

THE SPI Plastics Exposition to be held between now and the time this comment appears in print promises to give the plastics industry the greatest national publicity it has ever received. A most intense interest has already been kindled among the members of the industry themselves, and the week-long show will undoubtedly fire the imagination and interests of thousands of the general public.

Everyone in the trade is naturally full of curiosity to see what new developments will go on display for the first time and what the exhibit will do toward adding to the good will and prestige which the enviable accomplishments of the four war years did so much to enhance.

A direct and immediate response, we predict, will be new opportunities for the industry to further the essential and rapidly-growing role it is now playing in American business. END

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This radio housing is a shining example of what you can accomplish with Heatronics (radiofrequency pre-heating). Molded conventionally, it was formerly produced in a 200 ton press.

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We're specially qualified to talk Heatronic molding with you too, since we pioneered Heatronic techniques in plastics. Just put any or all of your questions about plastics up to a Kurz-Kasch engineer!

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Take this little plastic camera in your hands. See how sharply accurate the molding is. There's real mold-making skill for you! See how the friction-fit back snaps on and off . . . perfectly light-tight and exact in focal-distance. Observe the clean-cut interior . . . that's close-dimension injection-molding at its very best.

Quite naturally you find yourself thinking what plastic molding like this would do for your product. Amos ability to do your job exactly right is amply demonstrated by the job you're looking at. Such production merits your complete confidence.

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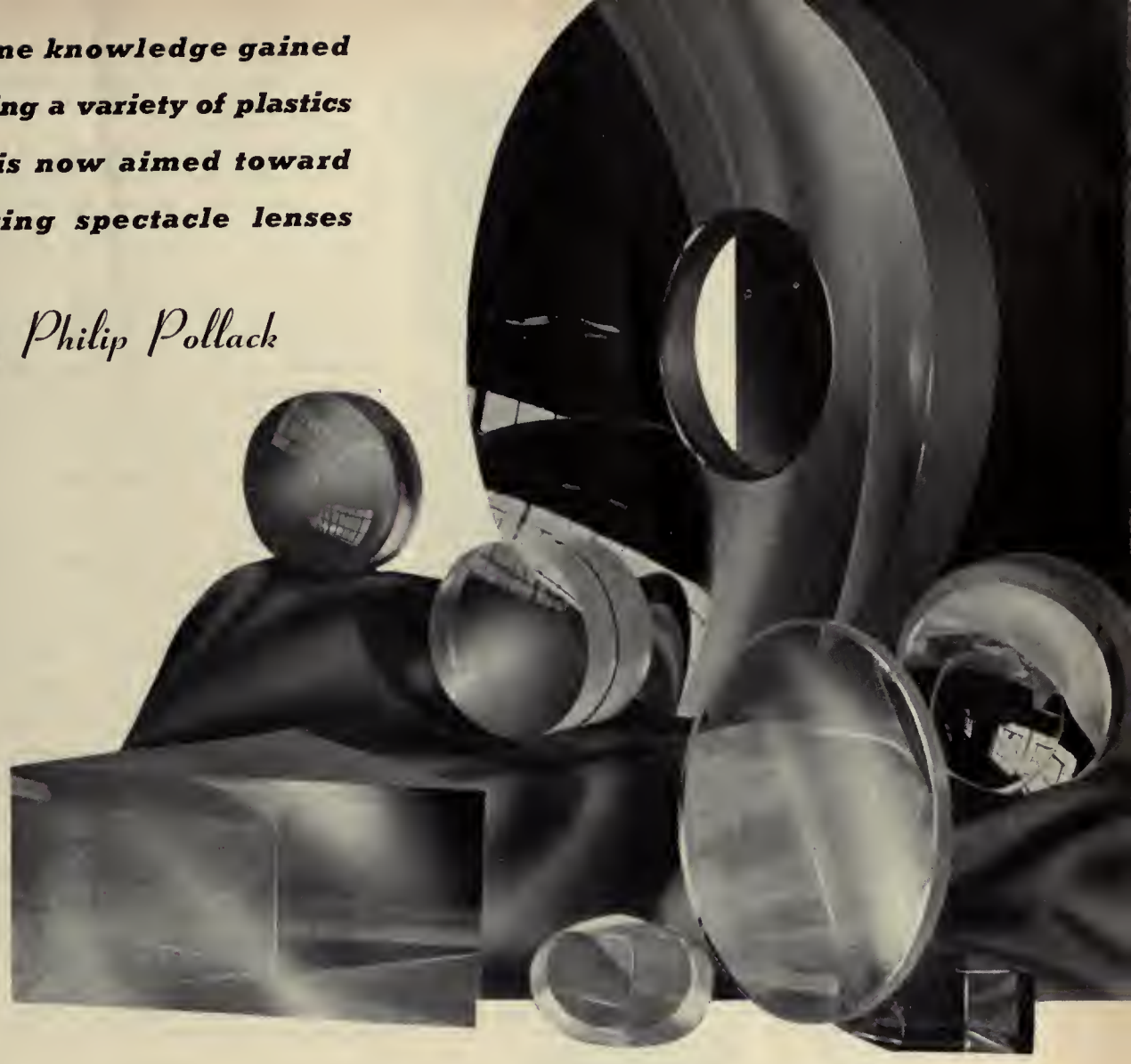
SOCIETY OF THE PLASTICS INDUSTRY

War-time knowledge gained in making a variety of plastics optics is now aimed toward perfecting spectacle lenses

By Philip Pollack



Plastics in *Precision Lenses*

THE recent report that a British company, Ophthalmic Plastic Lens, Ltd., makers of plastics contact lenses, is eparing to manufacture plastics spectacle lenses commer-ally, highlights the international race to perfect a product at is, for the most part, in its experimental stage of velopment.

This is not the first time that England has forged ahead the race. In 1938, considerable publicity attended the nouncement of the development of plastics lenses, both r spectacles and cameras, by Peter Joch de Gooreynd, a ung Belgian who had worked in England in collaboration th Arthur Kingston, British inventor. He had perfected technique of applying gradual pressure to hot acrylic sin in a manner that prevented warping when the plastics oled. This eliminated the optical distortions resulting from internal strains which had characterized molded lenses previously.

At that time, the press gave considerable space to de Gooreynd and his achievements. It was stated that 1500 lenses an hour could be molded "as if they were so many cough-drops." Lenses for cameras and opera glasses could be made by the same process with startling economic results. A $50 camera could be made to sell for only $8 through the use of plastics lenses, with the same optical efficiency. In the same way, $15 opera glasses could be made to sell for only $3. As to spectacle lenses, estimates showed, it was reported, that they could be sold at a profit for less than five cents apiece (the usual price for glass lenses ranges from $1.75 to $4.50, not including bifocals). This writer was told by an executive representing a British firm

Telescopes, binoculars, camera lens system, other military optical devices fitted with "Polaroid" plastics elements

experimenting with the product that the King of England had worn plastics lenses made to his prescription and had found them satisfactory.

After the first wave of publicity, no further developments in the matter were reported. It was known that plastics camera lenses were being manufactured and sold in England, but spectacle lenses from plastics were still in the research laboratory stage, not in mass production. The outbreak of war in 1939 put a halt to further commercial developments in that country.

In the United States, the Univis Lens Co. and other companies experimented in this field. The revolutionary implications of the new lens compelled the largest optical manufacturers like Bausch & Lomb and the American Optical Co. to follow suit. American involvement in the war halted further commercial investigation.

Work Resumed at War's End

With the ending of the war, the work was resumed. The research department of Univis is at present said to be "experimenting with materials," and the same is true of the major optical companies, but up to this writing there is "nothing to report." In England, several companies in addition to Ophthalmic Plastic Lens, Ltd., seem ready to launch the product on the market. One British firm has sent sample lenses to this country for thorough testing and investigation of properties. Ophthalmologists and opticians are trying them out and checking the reactions of patients over a long period of time before issuing a report.

It was reported also that, during the war, Soviet Russia ordered over 1,000,000 plastics spectacle lenses from England for use by her soldiers in cold climates as low temperatures were said to be responsible for the cracking of glass lenses. This is on the practical side. From the theoretical, scientific angle, plastics spectacles lenses have been endorsed in principle by no less an authority than Duke Elder, world-famous ophthalmologist.

Under these circumstances the recent report from the

Plastics prism, weighing same as the glass one which has less than half the volume, is ideal for aircraft instruments →

Large optics such as this eleven-inch diameter spherical mirror for a Schmidt optical system (left) are economical in plastics, no limit in size having yet been reached. Desired diameters can be readily and easily achieved by machining

Office of Scientific Research and Development of the War and Navy Departments on the successful development of plastics lenses for military optical instruments is of special significance. It throws a sharp light on the war-time advances in the struggle to overcome the chief drawbacks which have hindered the perfection of plastics spectacle lenses for commercial use — especially the low scratch-resistance of the acrylic resins used.

The report shows that the Polaroid Corp., makers of *Polaroid* for optical and industrial uses (see December, 1945, ***plastics***) had been commissioned by the government, through a contract awarded by the National Defense Research Council, to undertake the development of plastics for precision lenses. Objectives were to improve available plastics until their quality equalled that of optical glass; to synthesize new plastics for uses where glass would be impractical; and to design and construct optical instruments employing the new plastics.

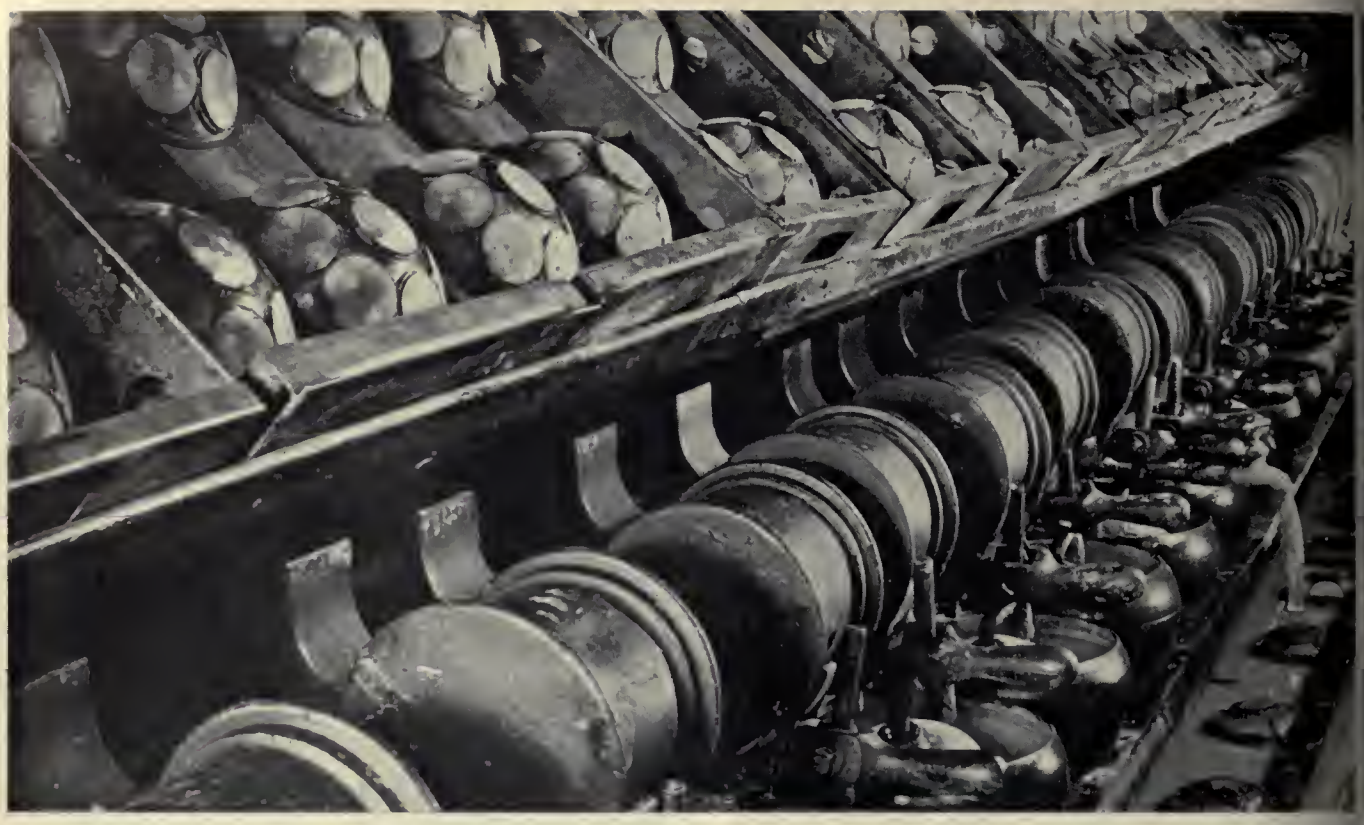
The project was initiated in 1940 when the United States faced the possibility of war involvement with limited availability of high quality optical glass. Our country was not geared to the mass production of lenses, prisms, mirrors and other elements needed for gunsights, range-finders, aerial cameras, and other military instruments. Substitute materials for optical glass had to be developed in a short time. Another advantage sought was the stepping up of the manufacturing efficiency and production speed inherent in the molding process.

The specific objectives, apart from the supplementation of supplies of optical glass with plastics, read like a listing of the advantages of plastics spectacle lenses (and their manufacture) over glass—the saving of time and labor by the production of optical elements in finished form in one series of operations; the use of simple, easily constructed machinery; the use of unskilled or semi-skilled labor that could be drawn from fields other than the optical industry, if need be; the production of optical elements of a kind that can be more readily machined, bored, tapped, milled, and shaped without danger of fracture; and the reduction of cost by the application of mass production methods.

While the project had to do with optical instruments exclusively, the successes achieved have an immediate bearing on plastics spectacle lens development, for lenses used in military optical instruments are of a much higher order of accuracy and precision than spectacle lenses. The degree of spherical aberration (the slight blurring caused by improper focusing of peripheral rays) inherent in most spectacle lenses used, would be impermissible in optical instruments. The same is true of chromatic aberration (color disturbances). Similarly, hairline scratches do not disturb most spectacle wearers but would be intolerable in precision instruments. Advances made in developing plastics to satisfy the exceptional requirements of high precision lenses thus bring the solution of the problems facing the production of plastics spectacle lenses much closer to realization. If plastics are good enough for precision instruments, they are surely good enough for spectacle lenses.

The handicaps facing the Polaroid investigators in their research project were the shortcomings inherent in the usual types of plastics. What are these shortcomings from the viewpoint of precision optical lens requirements? Lack of optical homogeneity; high water absorption; surface inaccuracy; imperfect retention of optical figure; high coefficient of expansion; large change of index of refraction with temperature; low softening temperature; and low abrasion resistance.

The scientists were largely successful in overcoming these deficiencies. Optical parts and systems with plastics lenses were developed with the necessary accuracy, stability, and homogeneity. Where undesirable factors such as high coefficient of expansion, low softening point, and low abrasion resistance could not be eliminated, methods were worked out for minimizing them. What is significant for plastics spectacle lens possibilities is that optical plastics elements for precision instruments of moderate magnification and average-sized field of view can now be made of a



Grinding and polishing glass lenses at American Optical Co. All this work is eliminated in molding plastics lenses

quality approaching that of optical glass elements, according to the report.

The first step in the Polaroid project was the investigation of the properties of the various plastics to determine which are best optically. In all, 113 compounds were synthesized and rated for required properties. Of these compounds, 17 were investigated thoroughly, but only two were found suitable for precision optics. All instrument designs were based on these plastics. They are polystyrene and polycyclohexyl methacrylate (called CHM), which is similar to methyl methacrylate.

CHM was found to be superior to previous plastics used for the purpose because of its low water-absorption and low shrinkage on polymerization (12½% as against 22% for methyl methacrylate). Its boiling point is 210°C compared with 100°C for methyl methacrylate. This makes polymerization possible at a higher temperature without causing bubbles due to boiling. As a result, CHM can be cast with satisfactory internal and surface homogeneity, although the best methods for polymerizing use relatively low temperatures and high concentrations of polymerization catalysts. Its limitations are: low softening temperature (about 70°C), low scratch-and-abrasion resistance, and comparative lack of toughness.

Characteristics	Perfect	CHM	Styrene
Homogeneity	15	15	14
Resistance to water absorption	10	9	9
Hardness	10	8	6
Softening temperature	8	6	6
Toughness	6	3	5
Absence of color	8	8	5
Ultra-violet stability	5	5	3
Ease of polymerization	5	5	3
Monomer boiling point	5	5	3
Low degree of polymerization shrinkage	8	7	6
Degree of polymerization before	8	5	8
Ease of monomer manufacture	12	8	11
TOTAL SCORE	100	84	79

Polystyrene was the plastics selected to supplement CHM in the design of achromatic lens systems and also in the manufacture of prisms. In spite of its assets, polystyrene is easily scratched and cannot stand contact with the hands or wiping cloths. CHM is a more likely candidate for spectacle use as its optical qualities correspond to those of ophthalmic (crown) glass, polystyrenes being closer to those of flint glass.

On a 100 point scale, CHM and polystyrene were rated by Polaroid investigators as shown in the table (left below).

Optical Properties of Plastics vs Glass

As to the optical properties of transparent plastics compared with those of optical (crown) glass, a consideration of the qualities of methyl methacrylate in this regard is instructive. The index of refraction (light-bending power) of crown glass is 1.52, which is close to that of the acrylic resin (1.4885). (For this reason, if experimental lenses are wanted for testing, they can be machined from methyl methacrylate before molds are designed for the laps used in surfacing glass lenses.) Because of its low dispersion value, methyl methacrylate has negligible chromatic aberration for a spectacle lens.

It equals glass also in the percentage of light transmission (92%) for all visible wave lengths. It transmits more ultraviolet than glass, a factor that makes it superior for camera lenses in color photography where high transmission of ultraviolet is important. It scatters only 2%, approximately, of the amount of light falling perpendicular to one surface, and the minor irregularities on its surface (microscopic imperfections) are negligible. Its optical homogeneity equals that of glass, and examination by polarized light shows no mechanical strains and no striae, cords, or reams within the sheet.

The plastics is, in addition, only slightly affected by light, weather exposure, ordinary temperature changes, or

(*Continued on page* 110)

Transparent Tenite plastic forms the half-pint barrel of this oiler and sprayer molded by Columbus Plastic Products, Inc., for Midwest Production Machine Company

New Oiler-Sprayer Has Shatterproof TENITE Barrel

Here's a handy new oiler for home and shop that converts to a spray gun simply by changing the nozzle. The barrel is molded of tough, transparent Tenite, which makes it shatterproof and provides visibility of the liquid level. The smooth Tenite is easily wiped clean and is molded to fit comfortably in the hand.

Tenite is a thermoplastic material—exceptionally well suited to high-speed injection molding. It may also be extruded in virtually any profile section, solid or hollow, or as a sheath over metal rods or tubes.

Tenite is available in all colors—transparent, translucent, variegated, or opaque—and is made in a number of formulas and flows to suit the requirements of many different products.

Ask us what Tenite can do for you—how this versatile plastic can improve your product, increase sales appeal, reduce production costs. Write to: TENNESSEE EASTMAN CORPORATION (Subsidiary of Eastman Kodak Company), KINGSPORT, TENNESSEE.

Tenite

AN EASTMAN PLASTIC

Plastics Glazing Returns to Civilian Uses

Light weight and translucency are numbered among the most important advantages of "Vimlite" glazing

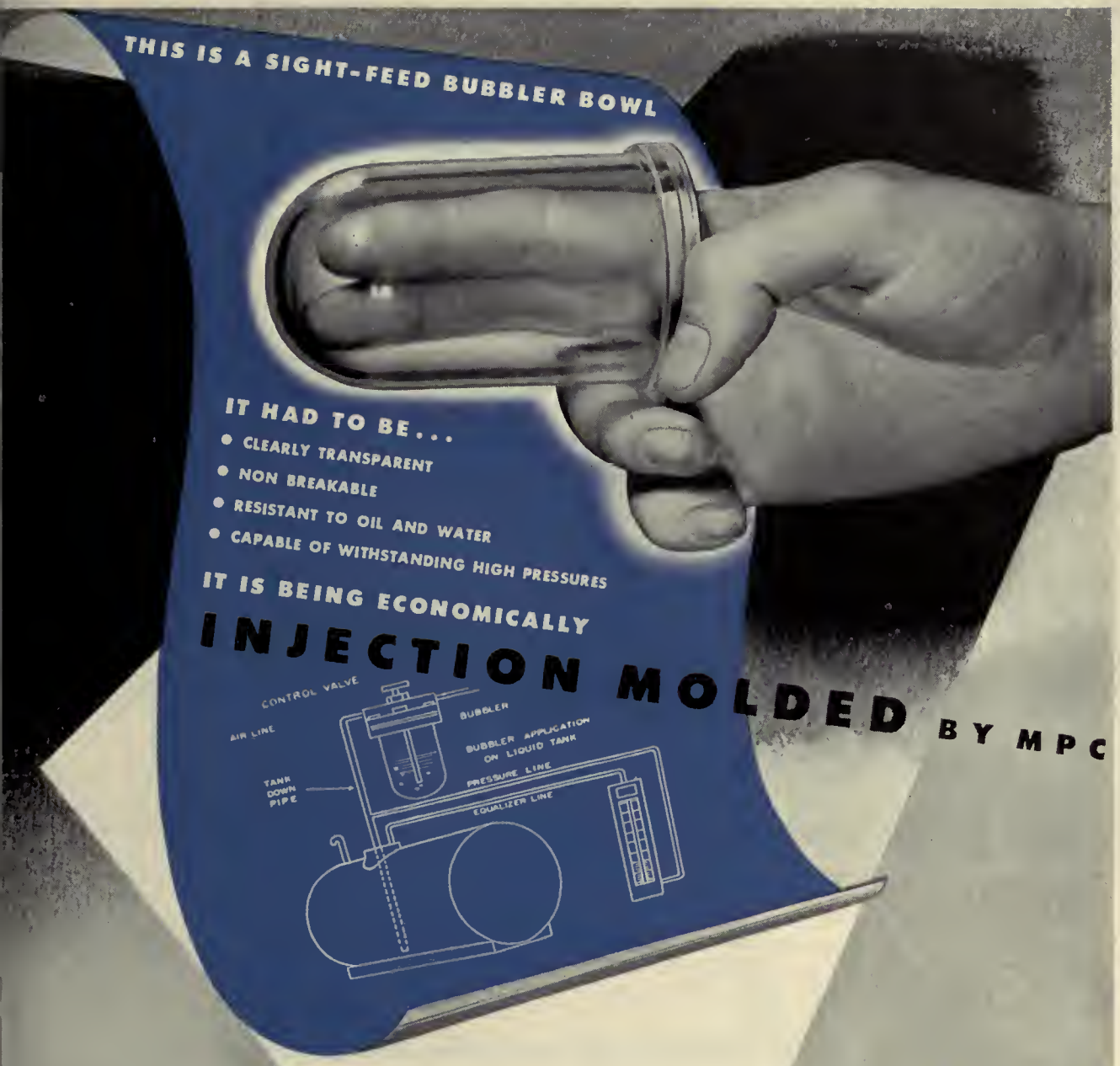
By Frank C. Williams
Director, Glazing Department
Celanese Plastics Corporation

PLASTICS glazing material, used for two decades in factory and on farm until it was placed on the critical list during the past five years, is again available for civilian use. During the war most of it was used by the U. S. Army and Navy for windows in the sturdy prefabricated Quonset huts and similar buildings which barracked our troops on both Eastern and Western fronts. It served for hospitals, banks, warehouses, and many other emergency facilities. Some was used to glaze the windows of factories producing explosives and ordnance materiel. An emergency shipment of *Lumarith* was even flown to London to glaze the windows in wide areas where bomb concussion had shattered every pane of glass for miles around.

Excellent ultra-violet and infra-red ray transmission, high translucency, heat insulation, and structural strength, together with light weight and ease of handling, give plastics glazing materials a variety of uses. Thus, *Vimlite,* a wire-reinforced cellulose acetate, has been used to glaze poultry houses, greenhouses, cold frames, hot beds, storm windows and doors, sun porches, and solariums. This material has also been used extensively in industry for both temporary and permanent partitions which give privacy but allow light to come through; for machinery guards to protect workers; and for collecting dust, lint, and other foreign matter generated by the whirling wheels and gears of factories.

Helpful in Raising Poultry

To the American farmer, intent on a record food yield, the release of *Vimlite* means increased production. His story begins in the brooder house, where newly hatched chicks are kept. These chicks are extremely vulnerable to disease-bearing bacteria and susceptible to variations in temperatures. Therefore, in ordinary brooder houses, they succumb in large numbers to rickets, coccidiosis, worm in-



These *bubblers are employed in many process industries to maintain o closely regulated and visually measuroble flow of air. By using plastics for the transparent bowl, this device was made sturdier and more serviceoble.

Mony a mechanicol device can be similarly improved through the use of plostics. However, the remarkoble properties of plostics can be fully utilized only when guided by a very special kind of knowledge . . . in product design, in mold moking and in production technique. Such speciolized knowledge is what we, at MPC, can contribute to your engineering staff. And we hove complete facilities for every phase of compression, injection and transfer molding. Submit your plastics problem or product to MOLDED PRODUCTS CORPORATION, 4533 W. Harrison St., Chicogo 24, Ill.

Manufactured by Trimount Instrument Co., Chicago

PLASTICS DIVISION
MOLDED MPC PRODUCTS
CORPORATION

"Vimlite" glazing for cold frames and starting beds keeps out frost and rain but lets in the life-giving sunshine

festations, and chills. However, where brooder houses are equipped with suitable plastics glazing, ultra-violet rays which pass through it help destroy the bacteria. At the same time infra-red rays and radiant heat dispel the chilling dampness. Thus, while cold, wind, snow, and hail are kept out, an even, healthy temperature is maintained inside.

In addition, hens in laying houses react to the brightness afforded by the translucency of the plastics glazing and lay at a high average rate during the traditionally poor laying winter months. Experiments have successfully demonstrated that cows and hogs (not to mention infants) benefit similarly by the destruction of bacteria and the absorption of ultra-violet and infra-red rays. For example, young pigs grow stronger and are not so subject to stiff legs.

Although animal husbandry is an important field for

One of the latest developments is this pre-fabricated cold frame for use by both the home and the commercial gardener

plastics, an even broader application is in hot- and cold growing frames and greenhouses. Growers have discovered that not only is hail no longer a threat to the windows when their plant houses are glazed with plastics, but that the small lenticular windows of the glazing serve to diffuse the sun's rays, thereby preventing plants from being scorched. Young plants are protected from the elements but are not deprived of the vital ultra-violet and infra-red rays. The result is apparent in sturdier, healthier, and, consequently, more profitable plants.

Pre-fabricated Cold Frame

A new pre-fabricated steel and plastics cold frame, developed by Celanese and Green Thumb, Inc., is now being produced for use by home gardeners and commercial growers as winter-starting beds for spring plants. Shipped in a single package in knocked-down form, the frames—known as *Green Thumb Seed Beds*—can be assembled in a few minutes by anyone with a screw driver and pliers. *Vimlite* is used in the cover of the frame, in two 36" square panels. The insides of the upright steel sections are insulated with ½" of *Fiberglas* applied after assembly by means of a waterproof adhesive. This layer of insulation is said to have the insulating value of 1½" of dry white pine. The new frames will be sold through hardware jobbers, seed houses, and department stores and will retail for about $16.50.

Another use of plastics glazing is in the tobacco industry. In the Connecticut valley, *Vimlite* cold frames protect tobacco seedlings from the elements and sudden drops in temperature until they have grown sufficiently strong to be "set out." Tobacco grown in this area by the American Sumatra Tobacco Company is used for wrappers for almost every cigar in the best grades. Some of it is even shipped to Cuba and used to wrap cigars shipped back into this country! American Sumatra reports that they are gradually replacing all glass frames with plastics glazing because the latter virtually eliminates the breakage problem and is far simpler and lighter to handle. The plastics glazing is installed by tacking it to the outside of the frame with tobacco lath. Not only is the plastics lighter than glass, but the frame itself can be made considerably lighter than the frame used for glass—an important factor where there are women workers.

In other sections of the country, similar frames are known as "hot beds," because they are used in conjunction with electric coils or bulbs or other heating appliances which protect young plants and stimulate early growth. Here the plastics serves to conserve the heat within the bed and also to keep out the elements.

Periodic checks have been made with government stations and growers who have installed plastics glazing in varying climates and altitudes to learn what the experience of typical users has been. The standard procedure has been to drop the customer a note asking how the *Vimlite* had weathered. Such checks have been satisfying and convincing and in some installations photographs show the material in good condition after ten years. EX

Ed. Note: Just announced as the preceding story was going to the press is a new development in *Vimlite* known as *Plastic Mesh Vimlite*. With the present shortage of steel wire, the development of plastics mesh is regarded as being particularly timely. The new product is credited by its manufacturer with having all the virtues of its wire-reinforced predecessor and is said to be superior in some of them. It is said to have, for example, 20% better light transmission, which has led to successful experimentation predicting its use for partitions, decorative screens and panels, and many other applications. It has a correspondingly higher ultra-violet transmission, weighs less, has superior aging properties, a more pleasing appearance, and

(*Continued on page* 84)

Five million dollars

for Plaskon plant expansion

In 1930, a small brick building in Toledo housed the beginning of the first Plaskon product. Today, on a 40 acre tract in that city, a great new five million dollar plant is being erected to meet world demands for the wide range of versatile Plaskon materials.

Modern equipment based on 15 years' experience by Plaskon chemists and engineers has beeen especially designed for the new Plaskon structures. These facilities will be controlled by efficient processes for the mass production of Plaskon molding powders, coating resins, glues and industrial resins.

The new Plaskon five million dollar plant will stimulate greater research, experiment and development in the synthetic resin field; will permit vast expansion in the production of Plaskon molding compounds, coating resins, resin glues and special industrial resins; and will open greater opportunities for Plaskon service to the molder, fabricator and industry in general.

Plaskon Materials today include urea-formaldehyde and melamine-formaldehyde plastics for molding a wide variety of useful products; resin glues and laminating resins for bonding, veneering or laminating wood, paper, fabrics, glass fibers and other materials; coating resins for the paint and varnish industry; and specialty resins for new and unusual uses.

For years, Plaskon research chemists and engineers have kept a finger on the pulse of industry. They have studied trends. They have formed the habit of looking ahead. Their efforts bring you Plaskon's five million dollar contribution to the plastics and resins field . . . and will continue to serve and grow with the industry's fast-expanding needs for these vital materials.

PLASKON DIVISION, LIBBEY-OWENS-FORD GLASS COMPANY
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- ☑ Greater uniformity of weight and density . . . cutting down molding rejects.
- ☑ Compact, modern design.
- ☑ Easy to clean . . . color changes can be made with minimum of cleaning time.
- ☑ Quick adjustment of density while operating.
- ☑ Quick adjustment of fill while machine is in operation.
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- ☑ Punches and dies can be quickly changed . . . machine complete with variable speed drive and clutch.
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- ☑ All lubricated parts enclosed and below die surface, thus eliminating preform spoilage due to oil contamination.
- ☑ Interchangeable parts. Precision made.

Write for latest bulletins. Defiance Machine Works, Inc., Defiance, Ohio.

DEFIANCE

BACKED BY 96 YEARS OF PRECISION MANUFACTURE

Popular-selling barrettes and comb ornaments are molded by Arpin Products, Inc. of beautiful, lustrous "Styron"

Jewels for the Molding

right, colorful, attractive, and relatively inexpensive

produce, polystyrene is injection molded into lovely jewelry;

elts; buttons; hair, hat, and handbag ornaments

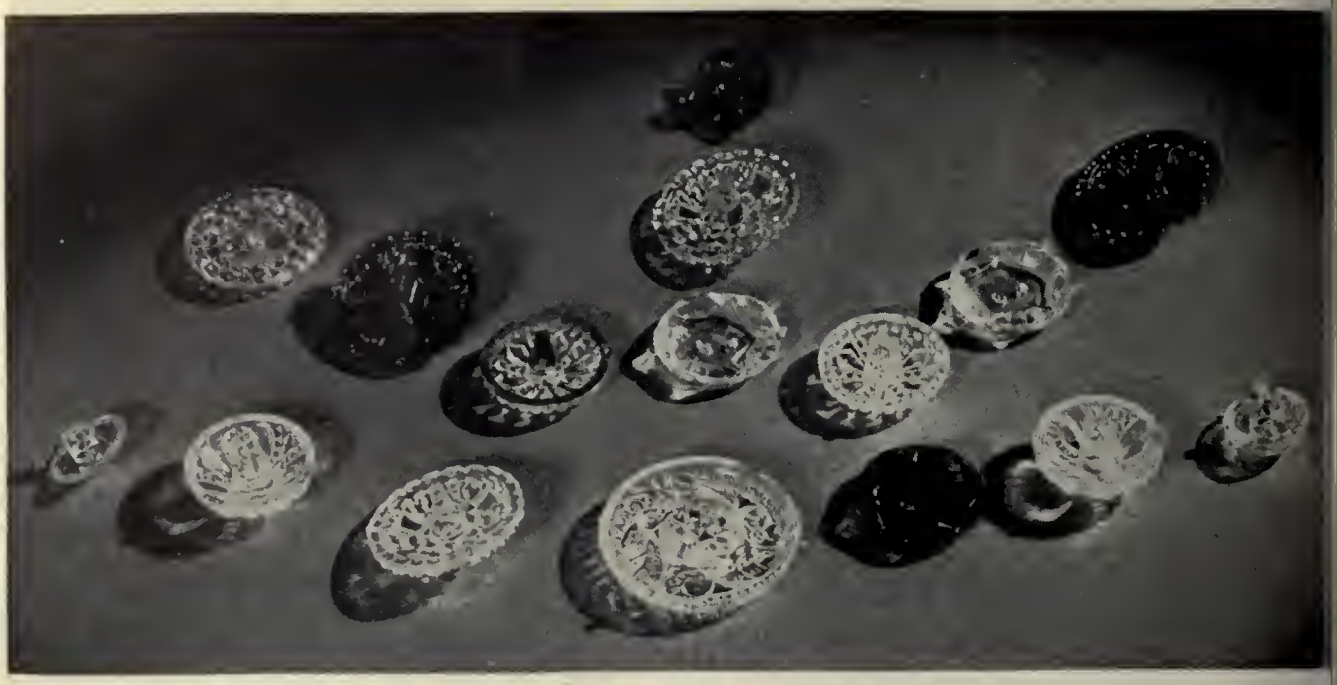
ONE of the most striking applications of polystyrene in the field of consumer articles is as a rival to the many ecious stones found in nature. If that is too challenging comparison and we admit that opals and rubies will still sought after, let us throw in the weight of the economic ctor—the cost of molding versus the cost of mining and lishing stones—and it is plain that the plastics industry n mold a thousand "rubies" where only one "grew" before. Although this is not a brand new development, it has re-ntly been taken up in a big way in spite of the current ortages of material; half a dozen companies are known be working with *Styron* polystyrene alone. These molded tones" are being used not only for costume jewelry and variety of buttons, but also for hair, hat and handbag orna-ents, and for trimming dresses, vanity cases and stage cos-mes. Belts and head-dresses are likewise studded with e synthetic sparklers.

The popularity of costume jewelry—colorful, coruscating ms, either real or simulated, to add a touch of sparkling shion excitement to a costume—lends impetus to the man-acture of these plastics jewels.

Jeweled ornaments that "dress up" and complement a for-l coiffure—sparkling buttons that supply a smart, impor-nt touch to an otherwise somber garment—the gleam of a illiant "gem" from milady's suit lapel—earrings, bracelets other items of adornment . . . any of these may be real imitation, and with the simulated "stones" so closely resembling the genuine jewels, it is frequently difficult to tell the difference.

What makes them sparkle? The principle is the same as with natural gems, depending on both the refraction and reflection of light. Refraction is the term given to the bending or deflection of light when it passes from one medium, such as air, into a denser medium, such as water or diamonds or polystyrene jewels; and conversely, from a

"Styron" stones, with their low cost and sparkle, offer competition to the "natural" jewels



Ideal Toy & Novelty Co. "Styron" buttons are strikingly beautiful, add a distinctive look to milady's outfit

denser to a lighter material. This bent light inside the stone is reflected against its facets and outwards, and it is the interaction of these reflections which creates the effect of sparkle to the eye.

The index of refraction is a measure of the degree of light deflection, and *Styron, Loalin* and *Chemaco,* to mention a few of the commercial polystyrenes, have an index of refraction of 1.59, as compared to 1.49-1.50 for the acrylics, which have such excellent optical properties. The angles of the facets of a stone, natural or synthetic, are determined by the index of refraction.

No Finishing Touches

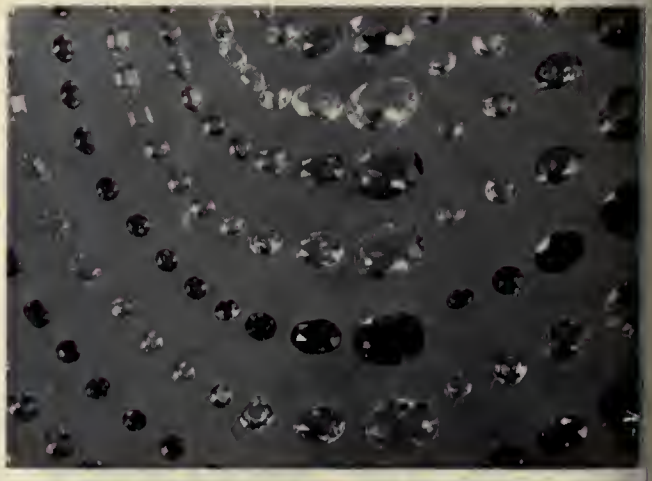
The jewels are generally injection molded, from which they emerge ready to use without any further finishing. It is not just a question of feeding molding powder to the press, however. The dies must be made with particular care, and various companies use different types. Thus, Ideal Novelty & Toy Co. uses a highly polished steel die, while Arpin Products, Inc., employs a special alloy to obtain maximum luster. Heat control must be carefully regulated in the 320° to 350° F range, and the elimination of air bubbles is one of the major problems. One company has solved it by fitting the press with a special air compressor. Gating design is important to prevent chipping, and the same company has contrived degating fixtures which insure a clean cut-off for jewels and buttons without any marring of the surface.

The number of cavities to the mold varies with the particular form, but the example of one high-grade firm may be considered typical. This firm uses 40-cavity dies for buttons and as much as 100-cavity dies for the jewels.

In the Arpin combs, the teeth are molded of cellulose acetate separately by another company, with Arpin molding the ornamental elements and assembling them to the teeth. The jewels are molded in units of 3, 4, 6 and 7, and by means of bosses at each end are fitted into holes in the body of the comb and heat-sealed.

The low cost factor of polystyrene is cited as a major factor in making its use feasible for jewelry and buttons by Commonwealth Plastic Co., which also uses the stones on cowboy belts and other leather novelties. EN

Polystyrene buttons still on the sprue, just as they came out of the injection molding machine



Assortment of unset stones made of "Styron" evidences brilliance, colorability of this material

DESIGNED AND ENGINEERED AT NO. 1 PLASTICS AVENUE
PROBLEM—
MAKE A FACTORY TRUCK WHEEL...
MUST NOT STRIKE SPARKS...
MUST BE ADAPTABLE TO ANY TYPE OF BEARING

PLASTICS . . . FOR SMOOTHER ROLLING TRUCK WHEELS

More and more factory trucks are rolling on plastic wheels. Designed at No. 1 Plastics Avenue, these are made by General Electric for the Service Caster & Truck Company.

No wonder they are so widely used in industry. Compression-molded laminates of chopped duck cloth and phenolic, these truck wheels are rugged . . . economical . . . impervious to moisture and chemical action. They outwear metal wheels, reduce wear and tear on factory floors, and do not strike sparks.

Not all plastics are glamorous. The factory truck wheel is typical of hundreds of workaday plastics products that have been produced by G.E.'s *complete* plastics service to do a better job, or a job that only plastics can do.

Check on the progress in the development of heavy-duty industrial plastics. Bring any kind of plastics problem to General Electric—the world's largest manufacturer of plastics parts. Write to Plastics Divisions, General Electric Co., 1 Plastics Avenue, Pittsfield, Mass. *We shall be glad to send you upon request a copy of the new illustrated booklet, "What Are Plastics?"*

EVERYTHING IN *Plastics*

G-E Complete Service — Everything in Plastics

Backed by 52 years of experience. We've been designing and manufacturing plastics products ever since 1894. G-E Research works continually to develop new materials, new processes, new applications.

No. 1 Plastics Avenue—complete plastics service—engineering, design and mold-making. Our own industrial designers and engineers, working together, create plastics parts that are both scientifically sound and good-looking. Our own toolrooms are manned by skilled craftsmen—average precision mold experience, 12 years.

All types of plastics. Facilities for compression, injection, transfer and cold molding . . . for both high and low pressure laminating . . . for fabricating. And G-E Quality Control—a byword in industry—means as many as 160 inspections and analyses for a single plastic part.

GENERAL ELECTRIC

CD46-A11

General Electric plastics factories are located in Fort Wayne, Ind., Meriden, Conn., Scranton, Pa., Taunton, West Lynn, and Pittsfield, Mass.

"Happo," fascinating, colorful clown head toy whose careful planned construction embodies eighteen separate injectio molded cellulose acetate and butyrate parts, becomes animat when towed by string. Disassembled parts are shown at rig

Plastics in Toyland

Finding an increasingly important application in the toy field, plastics today are utilized in ingenious and educational toys

For amusement of the very young generation, the carousel rattle, swung from cord, whirls merrily and rattles blocks

PLASTICS was notably represented among the glitte ing array of bright, new toyland wonders on display the 43rd American Toy Fair, held in New York, March 1 23. With more than 100,000 models of playthings assembl from throughout the nation and occupying seven floors two hotels, in addition to the permanent New York sho rooms, the country's toy merchants previewed a comprehe sive display of their expanding postwar world. From t viewpoint of the plastics industry, a long stride forward w observed, for several unique designs held a commandi interest that paid off in sales volume.

The Toy Association estimates the retail value of orde taken at the fair at $200,000,000, and manufacturers are o timistic about fulfilling this unprecedented demand. A though plastics products do not cut into a large slice of th business, the quantity of plastics toys sold was said to l large in proportion to the number of such items show Moreover, it was indicated that an ingenious use of plasti presages rapid expansion into a substantial portion of to land's kingdom. Actually, plastics' representation at t show, although effective, was limited by the existing dif culty of obtaining materials and molds. As a matter of fa many exhibitors of plastics items were utilizing hand-fab cated models, as molds could not be completed in time.

In this connection, Harriet Raymond, advertising ma ager of Celanese Plastics Corp., when writing recently ab toys of *Lumarith* cellulose acetate, said, "Children enj dishes that are colorful, do not dent out of shape, are n brittle, and can be *handled without care* because they a shatterproof.

"The manufacturer of a *Lumarith* toy phone, that is

A complete kitchen in miniature, with authentic equipment in scale models of white polystyrene, delights tiny homemakers

exact counterpart of the modern dial phone housing and hand set, shipped 3,000,000 in 1945 (claimed as a record number of a single toy); and they retail at around $2.95! A smaller size phone, made by the same house, ran well over 1,000,000 in the same year."

In the case of scaled reproductions in plastics (doll furniture, model building sets, etc.) as many as one hundred different highly-detailed parts may be injection molded. Although some items are available in quantity for early delivery, others still require a few months to get into production, and although manufacturers and distributors have set up their own rationing programs, they are generally optimistic of filling all orders taken. Some manufacturers have been allocating a portion of their production for export trade with a view to developing the important foreign market for a more competitive future when production will be limited only by demand. Although the investment in time and money on these rather small items is considerable, what are called "moderate prices" are being maintained.

It is significant of the current development of plastics in

A single die does double duty in molding hull for this novel toy sailboat and body for toy electric iron, both of "Tenite II". Black phenolic handle and cast aluminum base complete the iron, while butyrate rod and .015" sheet form mast and sail for boat

Finely designed, minute parts are injection molded of "Tenite" to be assembled by the hobbyist into models such as that of an LST; view at right gives an idea of the intricate detailing of these tiny moldings

toys that they satisfy the interests of all ages of childhood, ranging from mere noise-making rattles to the character-developing craft hobbies of adolescence. From the various plastics exhibits at the Toy Fair, we selected several outstanding groups that represent this progression.

The Infant Class

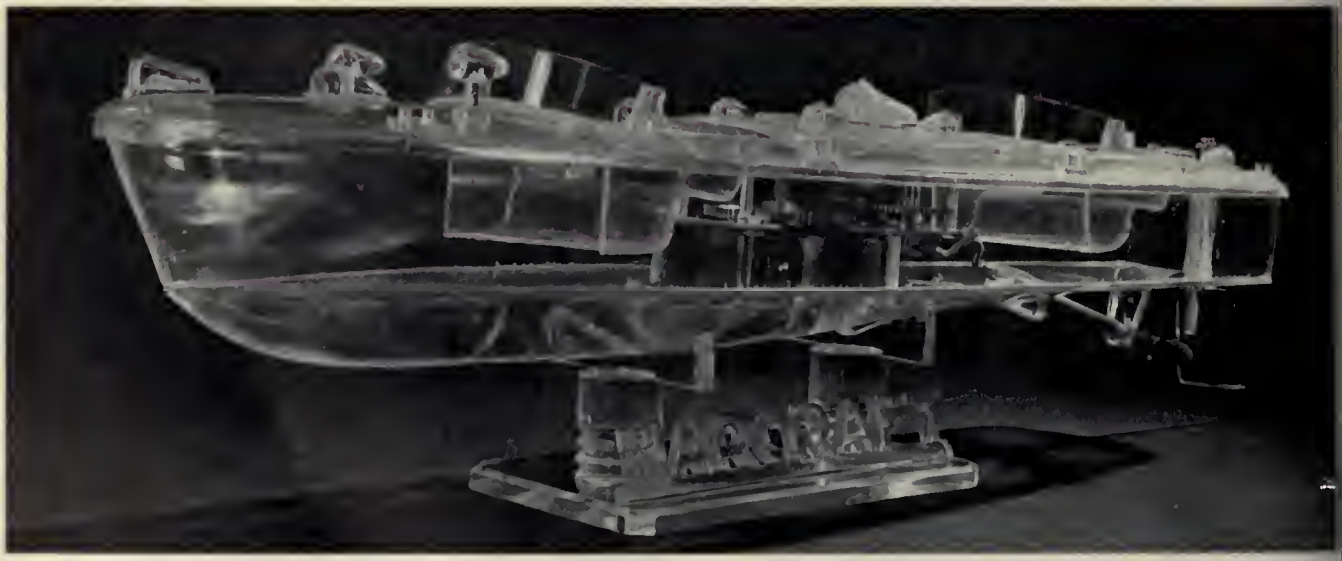
To begin at the first of the "seven ages of man," an appealing assortment of infants' rattles, employing a variety of plastics materials in their construction, was shown by Plastics Playthings. The line was begun two years ago with a casein teething ring of bright red, white, and blue disks of varying sizes, and a teething device mounted simply around a white ring, all being tied together with ribbon.

Among the more recent designs of this firm, four are built around clear polystyrene rings. These are drawn into circles from bar stock and cemented in an invisible joint. A tambourine effect is achieved in two of these items by mounting cupped red, white, and blue casein disks holding round steel bells by elastic bands through drilled holes in the ring. A pearlized wooden doll's face is centered in another ring on elastic bands and positioned by bits of whi cellulose acetate tubing and colored casein disks. The litt round bells attached on the outer periphery of the ring the terminals of the elastic bands provide the musical a companiment. Two ring rattles employ blocks of soft pir and blue transparent tones that provide a natural, nurse effect. One of these is called a "carousel rattle," for tl blocks are suspended from the ring on pink or blue strin to swing freely, while a little doll's head rides atop tl swing.

The assortment is completed with a visual device to fasc nate the infant's exploring eyes. For this, a pink aceta spiral is mounted within a clear acetate tube plugged either end with pink casein blocks; a tiny blue ball is thu free to roll up and down the spiral. The rattle is provide by a casein ring running through the drilled plug block an mounting bits of acetate tubing and casein disks.

Some of these items, including the spiral rattle, retail 59c; the others at $1.19.

In recent years, increasing emphasis has been placed o toys which are "educational" and serve as stimuli to phys



This accurate scale model of a Chris Craft speed boat, reproduced in molded red, white, and blue polystyrene, really runs

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Model of PT-17 trainer has fuselage and wings of yellow "Tenite II," and black "Tenite I" for motor, propeller, and wheels. The entire assembly is packed in a model kit, to be put together with acetone, making an effective desk ornament, or an addition to the hobbycrafter's collection

cal and mental progress of even the very youngest generation.

Among the plastics toys and playthings produced with the principles of progressive education in mind are those made by Childhood Interests, Inc., New York.

The company's designs are planned on the idea that toys should be scientifically made to correspond to the child's physical and mental development. It furnishes a toy program with its products, based on a careful study of the toy requirements for each age group. Playthings are specially designed for each stage of development such as the teether, the creeper, the toddler, and the builder. Toys are numbered in sequence, enabling parents to follow a schedule of graded activity.

The sequence of toys runs from teething beads to a streamlined train and comprises, in all, some 30 items for various age levels. In each instance, the use of plastics is credited to their color-fastness, lightness, moldability, smoothness of surface, resistance to corrosion, and hygienic qualities.

For the teething stage, injection molded cellulose acetate balls of pink and blue are hung from a maple wood crosspiece. The brightly colored balls help the baby to learn how to focus his eyes properly for near objects. Another plaything for this age is cellulose acetate teething beads, strung on a water-repellant and hygienic vinyl resin cord. The beads can be easily cleaned and the colors are fast.

Aid to Co-ordination

Made for the same age group is the Cradle Gym, which is modeled along the lines of adult gymnasium apparatus. It consists of a horizontal hardwood bar which is strapped across the top of the crib or play pen. From the bar hang a trapeze, plastics balls and swinging plastics rings. Colors and finishes are non-toxic. This device is intended for babies three to four months old and can be used throughout the first year. It has been recommended by pediatricians to improve concentration, and coördination of muscles. It offers a solution to the distracted mother who wants to keep Junior safely occupied while she is not attending him.

A companion piece to the Cradle Gym shown by this company is the Cradle Spin, consisting of a roller with wooden slats, which rattles when turned. Plastics in this device consist of two large balls of blown polystyrene, supplied by Plax, Inc., suspended from the arbor of the roller. The Cradle Spin retails at $3.

Another aid to the infant is a teething toy made up of three triangular plastics plaques strung together. These are scientifically shaped so as to fit easily in baby's mouth without danger of distention, and are large enough to eliminate any danger of their being swallowed. The device helps

baby through the tedious teething period. It also stimulate his interest and aids in the development of manual dexterit

Then there is the cellulose acetate rattle, in attractive pa tel colors. It is shaped so that the center is narrowed a the ends graduated in size enabling baby to grasp it at t most manageable place. Rattles may be single or doubl in the latter case they offer the psychological advantag that come from exercising both hands simultaneously.

Toys that Teach

For the toddler, more elaborate toys are designed. T two-year-old is ready to learn to identify various colors an for this reason, vari-colored plastics nuts and balls a screwed into a spirally threaded column fitted into a har wood base. This develops dexterity and mechanical abilit The child is taught to reassemble the toy when he is throug playing with it, thus providing training in neatness and sense of order. Other toys of a similar nature utilize plasti pegs and rings which have to be inserted so as to match t different colors, helping to educate the baby in color ide tification. It also aids in coördination of eyes and hand The retail price of these toys ranges from $1 to $2.

The point of view of the company has been succinctl stated by Harry E. Miller, founder, in these words: "A to may be theoretically the best in the world, but if it is give too early or too late in relation to the child's developmen much of its effectiveness is lost."

For the Circus-Minded

And as an example of the new and unusual toys whic have been designed to delight youngsters in a varying ag range, the fascinating clown head, "Happo," created by t designer Frank Woditsch, is intriguing. Believing tha such toys should be constructed to withstand the hard usag to which they are subjected by their small owners, Mr. Wo ditsch designed "Happo" to be practically unbreakable, chip

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Toys of this type provide training in color recognition and manual dexterity for the youngster of toddler age

proof and shatter-proof; composed of eighteen separate injection-molded cellulose acetate and butyrate parts, this amusing toy can be made to roll its eyes, open and close its mouth, and have its hat revolve on its head, while being "towed" by means of a string attached to slots in its bulbous nose.

Twelve of the eighteen parts are used for Happo's face and hat, making possible a variety of color combinations, a cleverly devised set of mutually indexing plastics gears inside the toy control its motions. The gears are also injection molded, so accurately as to position and index in their respective positions without any secondary operations, and the clown is assembled with no tools other than those required for cementing him together with acetone.

"Happo" is produced by Michigan Molded Plastics Co., Inc., Dexter, Mich., for Cinderella Mfg. Corp., Jackson, Mich., which handles distribution of the toy. Attractively packaged, "Happo" retails for $2. Although production quantities are limited by the present scarcity of materials, the popularity of this toy is said to be great and growing.

The Young Builder

For the child beginning to develop manual dexterity, putting things together and taking them apart becomes a most pleasant activity. Thus, toymakers have long been marketing simple building sets for this purpose. A plastics kit for constructing varied objects from simple forms, displayed by J. Donald Biever, consists simply of a number of round cellulose acetate pieces in various colors with holes around edges and through the center. These holes accommod lengths of acetate rod, in both straight and curved shap which form the skeleton of the structure. Two wooc blocks come with the set to facilitate the mounting of juvenile productions. An instruction booklet provides amples of constructions possible with the equipment, but child can exercise his own imagination in devising ma others. The kit will retail at $3.98.

Two Toys from One Die

An ingenious development in toy making is presented a single die, yielding two distinctly different toys, which used by Playtime Toys, Detroit.

Toy sailboats are a common device for enticing both lit boys and little girls to their baths; a necessary prop for t small girl's "playing house" is a toy "electric" iron. Playti Toys supplies both of these playthings, employing the sa basic part, a simple modification converting the hull of t sailboat into the body of the iron. In both toys the part made of *Tenite II* (cellulose acetate butyrate), injecti molded by the Udylite Corp.

Sales figures quoted by their makers, in round numbe of 100,000 of the boat toy and 250,000 of the iron, within 2 months of their introduction to the market, testify to t popularity of these two items.

The die produces a boat-shaped hull, entirely smooth the outside, with two reinforcing ribs running fore to and port to starboard in the hollowed interior. Two boss mounted in the fore and aft rib provide the medium of tra formation. In the sailboat the aft boss serves no purpo but does not detract from the appearance of the toy; ho ever, a bore with a projection at its base molded into t forward boss serves to mount the mast. This piece is clear or colored butyrate rod, 0.250″ diam, slightly flang and slotted at the end which fits into the hole of the bo The article is completed with a triangular sail made of .01 sheet by the Detroit Macoid Co., and which is slipped on the mast through holes at either end. With hulls color in either royal blue or bright red, the assembly is an attra tive offer, retailing at 29¢.

The only modification required to convert the little bo hull into the body of the toy iron is drilling out of the boss completely through the material, supplying location and a cess for screws which secure a die cast aluminum ba passing through the holes in the body to a black phenol handle. The handle is compression molded in twelve-cavi dies by the Compression Molding Co., St. Louis. Assemb of this little unit requires 36 separate jigs, although the t retails for 89¢.

This Iron Warms Up

To supply an additional touch of realism, Playtime To is making ready an improvement for the toy iron, in t form of a miniature heating element to give the child's ha a sensation of warmth, and a light bulb which will glo through the red plastics body of the "iron."

These electrical components are attached inside the hou ing by means of a clip-on screw, and a three-ft coil plu the iron into the regular house circuit. A rubber gromm to provide insulation, and a hole drilled into the back of t housing for insertion of the new units, complete the modif cation. With these added features, the toy iron is expecte to retail for $1.19.

The Banner Tool Co., manufacturers of the die for t bodies of these toys, had first intended hobbing it, but foun this impractical, due to the depth of the form, and accor ingly decided to cast it, using the hob as a pattern. The d used is of a beryllium alloy of 45 to 40 Rockwell hardnes coated with chrome. It yields moldings free of flash, an accurate to within .005″. This accuracy is absolutely neces

(*Continued on page* 104)

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Chart shows the area of the sensitive element of the Fenwal Thermoswitch compared to Type 1 and Type 2 thermostats. Note the much larger sensitive area of the Thermoswitch.

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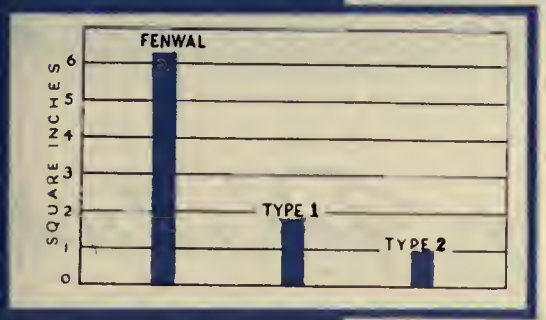

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* #2 of the "Fourteen Facts in Fenwal's Favor".

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THERMOTECHNICS FOR COMPLETE TEMPERATURE REGULATION

Ultra-modern "post-war" house features plastics. Siding is of bleached redwood ply laminated with phenolic glues

Housing Looks to Plastics

Because builders "had no axes to grind" choice of materials in experimental dwelling has especial significance

Wall controls for built-in radio sound equipment include "Plexiglas" plate, "Catalin" buttons, and phenolic handle

By Jack D. Stratton

ANYTHING having to do with housing constitutes new these days, and so of especial significance to the hun dreds of thousands of persons directly or indirectly con cerned with the project of providing some 2,700,000 house in the near future is the model post-war house recently erected in Los Angeles for demonstration and experimental purposes. Embodying many novel features in virtually a types of building materials, the "thought provoking" struc ture introduces a wide variety of decided plastics trends although no particular effort was put forth by the builder to use plastics. Where they were chosen, the choice was made only because, in the judgment of the builders, the would best serve the purpose.

The house was built under National Housing Agency experimental priority symbol H-X-3. Purposes of the proj ect, as set forth in the Federal directive, are to test cost construction methods, physical properties, consumer accep anee, and a combination of these points.

Financing was undertaken by Fritz B. Burns, Lo Angeles builder, to determine what items and material have been provided by post-war producers for houses of th

Interlocking strips, extruded of "Tenite II," make effective closures for built-in kitchen cabinets. Strips form sliding curtain which disappears above the cabinets like a roll top desk cover. Close-up shows interlocking design

present era. Public reaction to new materials and technique also is being studied.

Long before start of construction, Joseph H. Schulte, director of the Burns research division, visited some 200 national material and equipment manufacturers. On these calls, he sifted new developments and enlisted producer cooperation in putting them on display in the house. Thus, from inside to outside, from kitchen to bedrooms, the house introduces the latest developments.

Bleached redwood ply, laminated with phenol formaldehyde glues, was applied as siding for the house exteriors. Additives in the laminating resin established resistance and toxicity to termites and fungi. In addition, the plywood is impervious to moisture penetration and resistant to weathering.

Forty-five hundred square feet of the material, in five and seven ply stocks, was utilized. Laminations are ¾" thick and 40" wide. Seven to 12' lengths were furnished the carpenters. Cut in California, the logs were shipped to Harbor Plywood Co., Hoquiam, Wash., for sawing and laminating, after which the material was supplied to the builders by George Ream Co., Los Angeles. Phenol formaldehyde resin was utilized for laminating because it did not stain the natural redwood, and at the same time met all requirements.

Douglas fir in ⅜" thick three ply was used for top flooring and under the eaves. Casein adhesives were used for the flooring material, and phenol formaldehyde for the eaves at the Algoma plant of U. S. Plywood Corp.

Top flooring, laid on a ¾" sub-floor, consists of outer laminated thicknesses of .1", and an inner section approximating 7/40". Face and rear sections of the eaves lamination are approximately .1", with an internal layer of 3/20".

Bleached walnut wall panels and book shelf material, ¼" thick three ply, also a U. S. Plywood product, were bonded with urea-formaldehyde glue. Faces have a thickness of 1/28". The core is approximately 7/32". The lamination was reported performed at 300 psi, at 270° F, for four minutes.

Cabinet wood, likewise an Algoma product, is a 1" walnut five ply, with a core approximating somewhat less than ¾", two cross bands of 1/20" thickness, and face and back each 3/20", laminated with urea.

Sliding, three-ply interior doors were fabricated with plastics specially for the job. H. H. Robertson Co., Los Angeles, utilized Owens Corning *Fiberglas,* 1" thick, bonded with melamine resin glue to two external layers of 1" sawed, phenolic treated oak. Previous to laminating, the oak was sawed to 1" square strips, which were sprayed with the phenolic material, and pressed under nine pounds per cubic foot, to effect a cure. The doors have high dimensional stability and resistance to warping.

Plastics Wall Coverings

Wall coverings in many rooms stem from plastics applications. A comparatively new polyester lamination of taffeta prints on a special paper backing, produced by Peerless Plastics Products, Montebello, Calif., is used in the kitchen. Known as *Wallfab,* it was applied in panels of .013" thickness, with ordinary paste. Later, the firm plans to produce this material in roll form, like ordinary wall paper, .007" thick.

In making the laminate, the polyester resin was cured by being heated in an oven for two hours at 220° F and at a pressure of only .1 psi. The resin was adopted for the purpose because of the clarity, flexibility, and permanence which it imparts to the taffeta print. Resistance to moisture, grease, ink, crayon marks, kitchen chemicals, and the usual home solvents is a claim made for the product. In fact, it is announced as being practically "child proof."

Soluble stains of grease and ink, as well as many other discolorations, may be removed by washing with soap and water. Crayon marks or unwashable stains may be eliminated by powdered, gritty cleansers, for the surface is highly resistant to abrasion.

In several rooms, wall coverings of *Koroseal* were applied. The master bedroom wall is a highly colored floral chintz, impregnated with polyvinyl chloride. The boys' room is decorated with a printed plaid, and the all-purpose room in a conservative design. Builders said that the B. F.

Transparent and opaque "Plexiglas" sheets hung in circular overhead track provide latest in shower enclosures

Goodrich product was used because of its washability, durability, and color stability.

One of the most effective applications of plastics in the "post-war residence" was accomplished with Rohm & Hass *Plexiglas,* used in back lighting the master bath room. The installation closely resembles that in the bath room of the same firm's "Dream Suite" now touring the country (see ***plastics,*** October, 1945). In fact, executives of the concern's South Gate, Calif., plant say the "Dream Suite" was adapted from the "post-war house" plan, drawn more than one year ago, but held up, pending authority from the Federal government to install.

For this achievement, a ¼" thick, opaque sheet of methylmethacrylate, 53" by 60", was shaped by Shellmar Products Corp., South Gate, after the method employed in forming aircraft acrylics. The sheet was heated to 250° F. It then was draped over a plywood form, constructed from blueprints of the bath room.

Hardened into a gracefully curved shape, the sheet was installed behind, and on, an ensemble, one-piece lavatory and tub-shower combination. Its lower edge is raised 10" from the floor by the plumbing ensemble. As the 80" acrylic shower door stands in the tub bottom, 10" below the floor, upper edges of door and sheet are at the same height. In this position, the sheet covers the wall, and serves as a water splash. It also conceals window and light fixtures.

In front of the window, the opaque sheet diffuses sunlight. The sash is stationary, as with all windows in the air-conditioned house. At night, or on dull days, the sheet becomes a radiant wall for fluorescent back lighting. The opaqueness of the sheet over the window makes a window shade for privacy unnecessary.

Shower doors are of transparent *Plexiglas,* also ¼" thick. In both master and second baths, these doors are 80" high, and formed in a half-circle of 2' radius. The transparen of the methyl methacrylate affords bathers a clear view the bath room. It also permits room lighting for the i teriors of the showers. Suspended on specially design roller-bearing hangers, the doors, on being opened, rota to positions at the curved back walls of the stalls.

In the master bath room, the shower, which is install in the tub, virtually becomes an all-acrylic cylinder, 4' diameter, when the door is closed. The tub, designed som what after the pattern of a grand piano top, has amp space for the shower in its larger end. The acrylic shee which covers wall and window, is curved around the hea of the tub. Therefore, the closing of the shower door com pletes the acrylic "cylinder." The portion of the large shee curved in conformity with the end of the tub, then becom the back wall of the shower.

A point in favor of acrylic bath room installations is th shatter-resistance of the material. There is no hazard broken glass. In addition, the plastics material is wate proof, attractive, easy to clean, and warm and agreeable the touch.

Carrying out the safety, utility objective, the door for combined medicine and towel cabinet also is of *Plexigla* cut from ¼" material. It is opaque in its upper half, whic covers the medicine shelves, and transparent in its lowe half, to afford a vision of the towel supply without havin to open any doors.

In the second bath room, the walls were coated with a ne development of the Permakote Co., Long Beach, Calif. Th process consists of blowing powdered methyl methacrylat containing certain additives by a flame spray gun. Applie in this manner, the methyl methacrylate particles are said t fuse into an excellently bonded water-resistant coatin Pigmentation produced a brilliant chartreuse.

Powder for this purpose was obtained by specially grin ing the methyl methacrylate. Prior to grinding, the mat rial was crystallized by being frozen with dry ice.

The blow gun, a product of Glaspray Process Co., Sa Francisco, will heat the powder at above 220° F during th brief interval in which it passes through the envelopment flame. The coating, sprayed on in this manner, is expecte to possess high elasticity, thus preventing cracks.

One of the novel plastics installations was *Plasti-Moo* interlocking strips, extruded of *Tenite II,* by the Plasti Process Co., Los Angeles. These are used as sliding kitche cabinet closures. When interlocked, the ivory-toned extru sions produce the effect of a roll top desk curtain, disappea ing into recesses above the built-in cupboards. Maximu entry to shelf space thereby is achieved.

The extrusions, a new product, are fabricated in 6' to 1 lengths, and cut by table or band saw to correspond wit widths of the cabinets. Interlocking characteristics ste from the design, which is an exaggerated, square-cornere letter "S," measuring ⅞" in its largest, or vertica dimension.

Curtain Is Highly Flexible

By inserting an end of the "S" design into the opposit terminal of another section, a continuous curtain is assem bled. Through movement among its interlocked parts, th curtain is highly flexible. It turns on a small radius an rolls or folds into compact space. Produced for genera distribution, the extrusions come in a wide variety of color with the fabricator's technical staff prepared to engince special designs.

Behind vents for induction of air at controlled tempera tures, *Lumite* sheets, furnished by Chicopee Manufacturin Corp., of Georgia, serve as filters. The porosity of the ma terial permits air to pass, but eliminates bacteria, pollens and dust. As window sashes are fixed rigidly in thei frames and all air is filtered, the house virtually become

(Continued on page 82)

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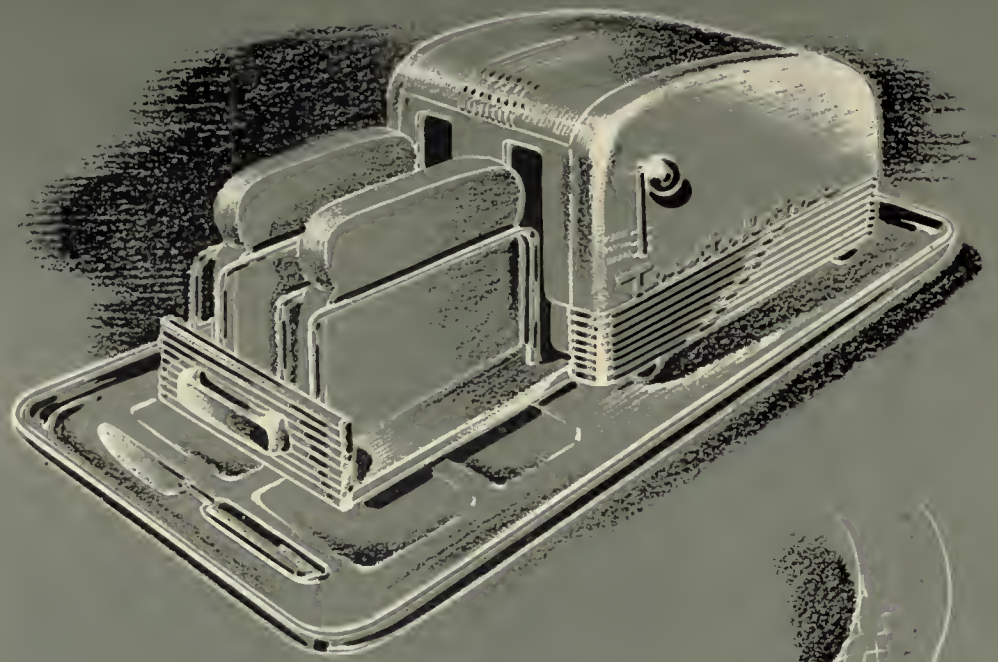
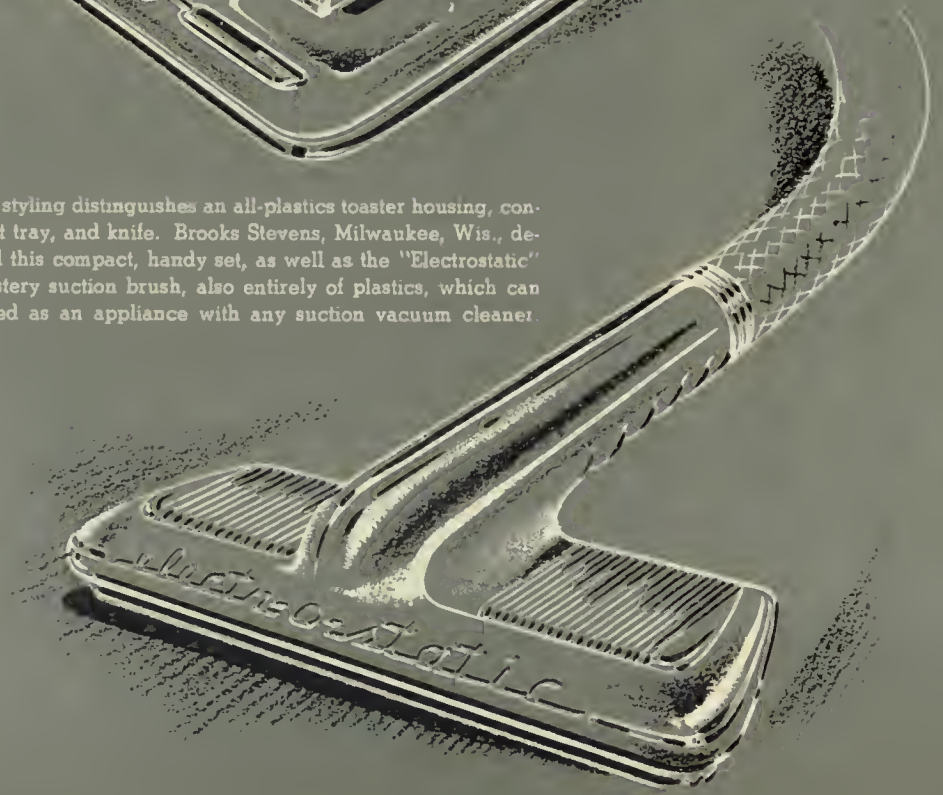
Drawings by Julian Krupa, *plastics* Art Staff

A Presentation of the Potential Applications of Plastics as Visualized by Industrial Designers

(*plastics* welcomes designers' contributions to this department)





Smart styling distinguishes an all-plastics toaster housing, condiment tray, and knife. Brooks Stevens, Milwaukee, Wis., designed this compact, handy set, as well as the "Electrostatic" upholstery suction brush, also entirely of plastics, which can be used as an appliance with any suction vacuum cleaner.

Combining attractive decor and utility, industrial designer Kim Hoffmann, New York City, presents a stand which has a removable center tile covering a deep basin that may be used to hold cut flowers, growing plants, or as an ice cube holder and refreshment cooler when serving cocktails. The entire top section is designed to be of plastics, wood being used for base.

"Styroflex" ribbon is wound on copper core (center), covered by helical spacer winding (left) to form coaxial cable

An Interpretative Survey of German Plastics Fabrication

Part II. The German extrusion industry did not rival that of the United States, but it did strongly emphasize large hydraulic extrusion

By W. C. Goggin

Manager, Plastics Development Division
The Dow Chemical Company

THE extrusion of thermoplastics in Germany accounted for much of the plastics fabrication industry. The extruded thermoplastics included both plasticized and unplasticized polyvinyl chloride, polystyrene, polyamides, and to a smaller extent cellulose acetate, methacrylates, and polyethylene.

Extrusion was done by the plastics material manufacturer, by plants producing propriciary items, and by entirely independent custom fabricators.

Extrusion methods were based both on hydraulic and screw machines. No accurate information on the number of extrusion machines is available, but the capacity of the industry was well below that in America. However, far more emphasis was placed on large-sized, hydraulic extrusion than in the United States. Products of this Germa industry were largely standard basic shapes rather tha custom items. Large-sized pipes, rods, bars, sheets, fil and bristles were all produced in quantity by extrusion.

Chemically-resistant, hard polyvinyl chloride (*Vinidur* pipe was probably the most important single extrude item. It was produced in large sizes and on an extensiv scale by well-developed hydraulic methods.

Briefly, the basic method used to produce *Vinidur* pi (and other hard polyvinyl chloride produets) involved so tening and milling on 160°C tight steel rolls, tightly rollin up the sheet, feeding this hot rolled sheet into the extrude as a slug, then extruding. In one plant, for example, *Vin dur* pipe was formed on two hydraulic extruders, the small with a piston diameter of about 10″ and the larger about 16 The latter would produce pipe up to about 30 em (11.8″ in diameter with a wall thickness of ½″. Each machin had two sets of torpedos and dies, moveable transversely i

front of the extrusion cylinder, so that one could be cleaning while the other was extruding. In this machine a 20 kg (45 lb) hot slug of rolled sheet was placed in the extrusion chamber, a clean, hot torpedo and die moved into place (its temperature 180-190°C or 356-374°F), and the slug extruded in 20 min. The rate is about 20 lb per hr—a portion of each slug had to be cleaned from the torpedo. The equipment was all steel and in idleness had rusted badly. With this product, color and slight decomposition were unimportant. Extrusion pressures of 300 atmospheres (4400 psi) were used. The torpedo, though rather short, was carefully streamlined and electrically heated. Electrical heaters were also used for the die. Strategically located thermocouples were used to control torpedo and die temperatures.

High molecular weight polyvinyl chloride was used without plasticizer. Small amounts of stabilizer such as .2% phenyl indol or thiourea were often used. By accurately controlling temperatures and pressures and through the use of this polymer, it was possible to extrude this large-sized pipe horizontally without any internal support either mechanical (mandrels) or pneumatic. This pipe was extruded to standard lengths of about 14′.

From pipe and sheet sections were made many articles including intricate valves, flanged pipe, pitchers, funnels, developing trays, and other chemical ware. Much of this was done by using a small welding tool resembling an acetylene torch. In this torch, hot air was applied to melt the 3/16-inch plastics rod. The air was heated in the tool by passing it through about one foot of copper coil wound in a helix about ¾″ in diameter and about 1½″ long. This coil was heated by a gas flame directed down the axis of the coil. Air temperatures were 190-200°C.

Extensive Use in Chemical Industry

Vinidur pipe and fittings were used extensively throughout the chemical industry in Germany. Applications were well planned and failures were thus minimized. *Vinidur* made it possible to extend their limited supplies of chemically resistant metals and alloys.

Soft (plasticized) polyvinyl chloride was an important military product as field wire and cable covering. Screw-type extrusion was used exclusively in this application.

The original polyvinyl chloride covered field wire was designed for operation down to —25°C (—13°F). During the cold winter of 1942 in Russia, temperatures far below —25°C were reached. The resulting failure of the communications system because of brittle insulation contributed greatly to the confusion and necessary retreats. New plasticizer combinations were developed for use to —35°C (—31°F).

Basically, the extruders for covering wire were similar to American types. For example, one company used a battery of eight wire-covering screw extruders. Screw diameter was 1¾″, steam heated jackets at 160°C (320°F), electrically heated die at 200°C (392°F). The screw had provisions for steam heating or water cooling. Dies had short lands and were fixed centered. Extrusion speed was 25 kg per hr (56 lb per hr). Wire coating rate was about 80 meters per minute maximum (260 fpm). The hot insulation was not water-cooled, but chilled by air while running over two padded drums one meter in diameter.

This particular plant had two novel features: the feed system and the cross head. The plasticized resin for feed went to a central mill for preheating. Here it was milled until proper temperature was reached, then quickly cut into standard strips and placed on an air-heated, insulated central conveyor system. This system delivered the hot strips directly to each extruder.

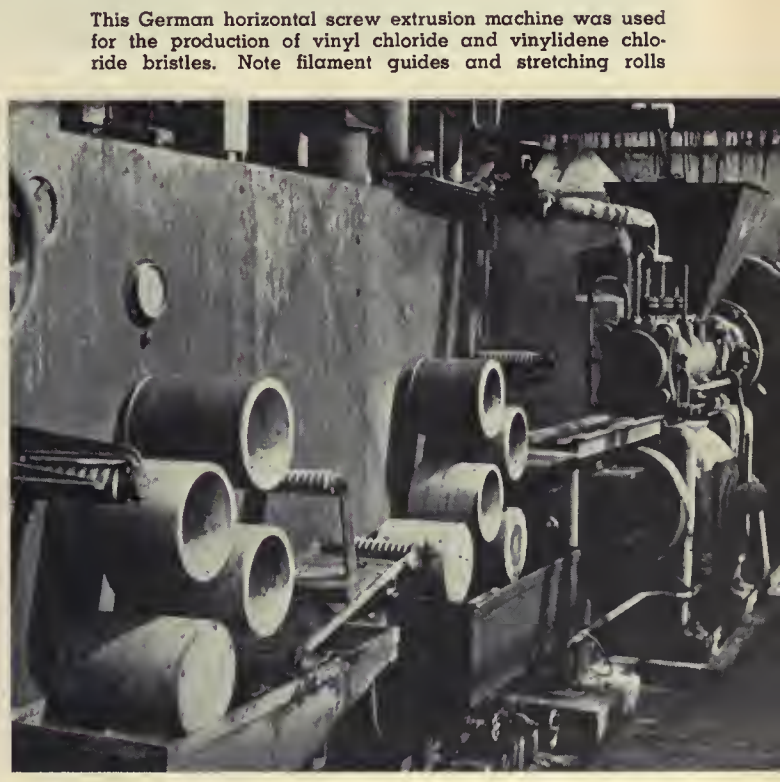
The cross heads used with these extruders were built for operation at a 45° angle with the screw, rather than the

Experimental intermeshing double-screw extruder (case removed) said to be satisfactory for plasticating unfused mixes and extruding with them (Capt. G. S. Nalle photo)

standard 90°. It was claimed that this change reduced necessary floor space, made automatic feeding easier, and gave more streamlined material flow through the extruder.

In other plants were found novel ideas adapted to the screw extrusion of soft polyvinyl chloride. One plant was operating extrusion machines of about the size indicated above, for wire coating, without the use of crossheads. An extruder had been engineered in which the wire travels in a straight line, through the center of the screw, out the die, onto the cooling rolls, and then reeled. Wire preheaters were usually located ahead of the extruders. From the pre-

This German horizontal screw extrusion machine was used for the production of vinyl chloride and vinylidene chloride bristles. Note filament guides and stretching rolls

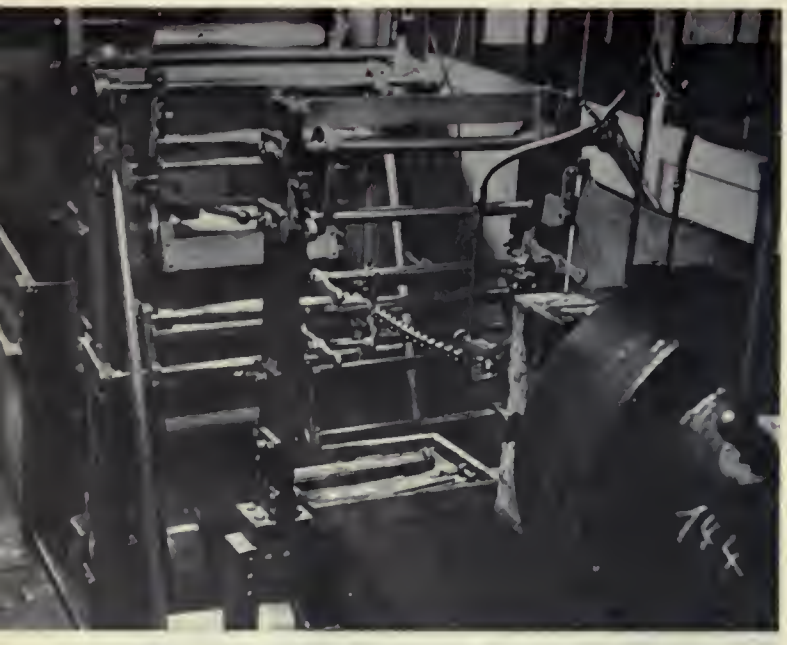


heaters the wire was led into the center of the rear end of the hollow screw. It then traveled through the screw, through the attached torpedo, and into the center of a stationary spider torpedo mounted tight against the rotating torpedo. These joints must be snug fits and able to withstand some bearing load. The wire then entered the die proper, which consisted merely of a fixed orifice. Centering, which is not difficult, is accomplished by adjusting centering screws that move the otherwise stationary spider torpedo slightly, thus changing the wire location in its coating. This system was claimed to give more uniform heating, less decomposition, more uniform coating, better centering, and good speeds. The speeds were reported as 80 meters per minute (260 fpm) for heavy insulation and as high as 300 meters per minute (980 fpm) on thin insulation (.035" thick). It was admitted that the equipment was difficult to dismantle when breaks or feedbacks did occur.

Another plant extruded soft polyvinyl chloride tubing for clincher rim type bicycle tires. A section of the tube was cut to proper tire length, a valve was inserted near one end, and the two ends were then welded together to form the tire. The butt welding was accomplished by the use of a flat plate, in much the same fashion as *Saran* pipe is welded in this country. The tires were said to give very good wear life, with good air retention. Samples in use for over a year showed very little wear. Cold flow did not seem to be serious, no doubt on account of the clincher rim design. The unique part of this development was the method by which the tread was produced. The tube die was designed with reciprocating pins operating on the perimeter of the orifice. These pins were machine driven through cams which raised and lowered them periodically, thus varying the orifice opening and making the tread pattern. A little flash resulted, but it was not serious.

Synthetic Bristles

Natural fiber for use as bristles was very scarce in Germany. Unplasticized polyvinyl chloride, and to some extent polyvinylidene chloride, was screw extruded for this application. With polyvinyl chloride, the white powder, 56% Cl, 1.38 sp. gr., 20,000 MW (Staudinger) was used. Control tests were bulk density, cleanliness, and screen analysis. To make the powder granular and drive out air, it was milled with 5% cetyl alcohol wax at 150°C (302°F) for 8-10 minutes on a standard, non-differential mill with trided rolls.



Right front to left rear—"Styroflex" extruder head, sheet stretching and trimming frame, tension and winding frame

The resulting sheet was cooled and broken to pea si then fed to a vertical 30 mm (1.2") screw extruder. Te peratures were 120°C (248°F) on barrel (steam) a 160°C (320°F) (electric heat) on the die. A varial pitch screw compressed the granules about 3/1. Dies h several one millimeter (.0395") holes. The extruded mo fils (16-40 in a group) were water-cooled and stretched 2(300% at 45–55°C (113–131°F) as a group. Maxim speed was 55 meters per minute (180 fpm) after stretchi The product was then dried at 60°C to remove wat reeled, cut, and packed. The equipment appeared to be ferior to United States design. Production rate was ab 6 lb per hr. One man ran 4-6 extruders. When larg sized bristles were desired (.020"–.160"), horizontal n chines with larger screws were used. These, made of spec steel, extruded at a rate of 28 lb per hr. Polyvinylide chloride bristles had been made in this equipment. Resu were mediocre because correct non-reactive metals for lin and screws were not available. The Germans realized t but could do nothing about it. The bristles were used brushes and brooms and were woven for coarse filters, b kets, and ropes.

Interesting uses were made of polyamide tapes wh were extruded and stretched. *Igamide B*, a polyamide ma from omega caprolactam, was extruded in a conventio screw extruder at temperatures around 180°C (356° base, 200°C (392°F) at the head, and 220°C (428°F) the die. The orifice was shaped to produce a tape. T tape was cooled and if accurate cross section was desir this cooling could take place on the face of a grooved whe The tape was held in the groove under tension and by oth small rollers on the face of the large cooling reel.

The tape was then continuously stretched cold by passi it over a series of polished, hollow aluminum rolls—eith cooled or steam heated, whichever was desired. The stret ing (about 100%) oriented the band, making it strong In some cases, this stretching was done at temperatures 100°C (212°F). Stretched bands up to 3 cm times 5 n (1.2" times .2") were produced. The bands were wov into nets for catching anti-aircraft shell casings, twisted a woven into ship hawsers up to 6" in diameter, used for binding sheath to wrap around hydraulic lines and fuel lin to reduce wear and prevent bursting, and used for wor shoe laces and window blind tape.

An unusual screw extruder was developed for the man facture of large-sized polystyrene rod up to 80 mm (3.1 in diameter. While not seen, it was described thus: t screw was tapered, about one meter long (39.4") by 25 c (10") outside diameter at the base (cold end) by 5 c (2") O.D. at the tip. Total clearance at the base was o centimeter (.4") and at the tip about 5 cm (2"). T screw was followed by a coarse screen and an electrical heated die. Screw speed and production rates were lo being 3 to 4 lb per hr. Temperature ranges were jack (oil) 180 to 200°C (365–392°F) and die 150–170 (302–338°F), depending on the type of polystyrene. these low rates the polystyrene received very thorough mi ing. As it left the die, it tended to expand some 20%. compensate for this it was pulled down a 5 meter (16 trough (in air) by a 5 kg (11 lb) weight on pulleys. T rod was held to a tolerance of 8%. With the method cooling used, all rods over 20 mm (.8") in diameter dev oped bubbles. These rods were "debubbleized" by heati 4 hr at 140°C (284°F) under water, under 30 atmospher (440 psi) nitrogen pressure in an autoclave. Only a tw hour cooling period was said to have been allowed.

To improve plasticizing action and increase productio the Germans built several experimental double screw e

(*Continued on page* 108)

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An assortment of castings sealed with "Polyplastex MC"

How to Resin Seal Porous Metal Castings

By Prescott C. Fuller
Plastics Div., American Cyanamid Company

Process makes castings pressure tight, saves material, time, money

Flame thrower part, used with aromatic hydrocarbon under high pressure, needed but one impregnation to eliminate leaks

A MODIFICATION of American Cyanamid's thermosetting resin *Laminac,* developed by Polyplastex, Inc., Woodside, N. Y., and called *Polyplastex MC,* has been used successfully as an impregnant for making porous metal castings pressure tight. As a result, great savings have been realized in money, foundry time, and machine time that would otherwise have been wasted on rejected castings.

During the war, increased demands were placed on foundries for pressure tight castings of magnesium and aluminum alloys, copper, bronze, iron, and other metals for innumerable applications in combat aircraft, naval vessels and merchant ships, tanks and trucks, and electrical and electronic devices. At the beginning, however, rejections because of leakage reduced output seriously and created delivery lags on vital war equipment. As always, production men were plagued by micro-porositic flaws, which are particularly prevalent in low density metals such as aluminum and magnesium.

American ordnance units serving overseas have often said that a salvaged machine is just as valuable as a new one. This applies equally to the many castings which can be salvaged through the use of a proper sealant. Now that the war is over, new alloys will be available to industry for use in the new products for which Americans have waited four years. Production capacity for aluminum and magnesium has been increased tremendously, and these metals are expected to find greatly expanded usage. Recently the Magnesium Association was organized, and postwar plans of its member companies are extremely comprehensive. Many applications requiring pressure tight magnesium castings are anticipated in the automotive, electrical and aircraft industries.

The impregnation of porous castings is not meant to be

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Hook-up for impregnation by the internal pressure method

used as a medium of salvaging castings with foundry flaws, cracks, and blowholes. Its primary purpose is to insure pressure or water tightness by eliminating micro-porosity in structurally sound pieces. Not all castings are necessarily porous as delivered from the foundry. Machining operations on such castings, however, may open up flaws, particularly with magnesium and aluminum. In fact, it is generally assumed that all magnesium alloy castings should be impregnated where pressure tightness is specified for the work.

The use of a chemical means of sealing castings is not new. Tung oil from the Orient was used prior to World War I and, until it became unavailable because of the recent conflict, provided a fairly satisfactory means of closing pores. Sodium silicate and phenolic thermosetting resins were both used in quantity prior to this war. Shortly after the war began, much higher requirements were placed on castings when they were designated for military uses. New alloys of magnesium and aluminum were developed and used in applications hitherto restricted to much heavier metals. Not only the shortage of tung oil and dissatisfaction with other impregnants then used, but these new requirements and applications caused industry to turn to improved sealants.

Polyplastex conducted an intensive study to find a material not too expensive, easily available, and possessing the proper combination of physical and chemical properties. After innumerable resins and chemicals were tested, the desired properties were found in a modified anhydrous copolymer. American Cyanamid's *Laminac*, the base material, was modified by Polyplastex to obtain the exact requirements, both physical and chemical, for making castings pressure tight. The resulting impregnating compound is known as *Polyplastex MC*.

This resin has been developed in modified forms to suit any particular end use. Viscosity can be changed to satisfy a broad range of requirements, and thus insure a proper flow into the pores of the castings.

The chemical resistance of the impregnated and cured castings is excellent. They are completely unaffected by hydrocarbons, other petroleum products, glycols, solvents, water and salts. Acids and weak alkalis have little or no effect upon them. The cured resin in the pores of the castings is tough, hard, and yet resilient enough to allow for considerable expansion or contraction of the metal itself as various degrees of temperature are encountered. Temperatures up to 450° F may be tolerated.

Besides the chemical properties of this new material, the mechanics of impregnating was studied. It was found that the shape and type of the casting have considerable bearing on the best method of applying the sealant.

Directions for Impregnating

It is recommended that all castings be completely machined before impregnation. Machining operations tend to open up internal pores which would otherwise be sealed by the outer skin of the casting. After machining, castings are thoroughly cleaned by conventional solvent methods. When all foreign matter has been removed, the casting is pre-heated to 250° F to drive off the cleaning solvents and to eliminate any gases trapped in the pores. The casting is allowed to cool to room temperature and is then ready for impregnation.

Generally speaking, methods of impregnation fall into three groups:

(1) PRESSURE VACUUM: The castings to be impregnated are set in a pressure vacuum chamber. Air is evacuated and a vacuum of not less than 27" of mercury is applied. The sealant is brought into the receptacle under vacuum until it entirely floods the chamber. The vacuum is released and air pressure of 60 to 100 psi is applied for at least 30 min. The pressure-time cycle varies with the density of the casting treated. After impregnation, the mixture is removed from the chamber by pressure, and the castings are drained, cleaned, and ready for curing.

(2) INTERNAL PRESSURE: When individual castings or parts of castings are to be impregnated, all openings but one are plugged. The impregnating solution is poured into the orifice until the casting area is full. Then the opening is closed, and air pressure is applied for a suitable period of time. Both pressure and time cycle are influenced by the type of casting under treatment.

(3) VACUUM: All ports are closed and a vacuum line is attached to one of the closures. The entire casting is then submerged in the sealing compound, and a vacuum is applied to pull the material through the side walls.

After the castings are well drained and thoroughly cleaned, they are cured at a temperature of 250° F, with the time cycle dependent on the weight and thickness of the casting treated.

Treating the Surface

For special uses a *Polyplastex MC* coating material may be baked on the surface as a part of the impregnating and curing process. The resultant film has an ideal adhesion to the metal and serves as an excellent base for a finishing coat. Since this film is resistant to salt spray, it even may replace other preliminary chemical protective treatments.

The need for impregnation is usually determined by testing the casting at a pressure 50% greater than the maximum operating pressure to be exerted on the part in service. Units may be tested by immersion in water or by coating with a soapy solution and applying air pressure to the inside of the casting. They may also be tested by applying water, glycol, mineral oil, or mineral spirits under pressure to the inside of the casting and checking for leaks or seep-

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Sealing a complex magnesium aircraft engine control body

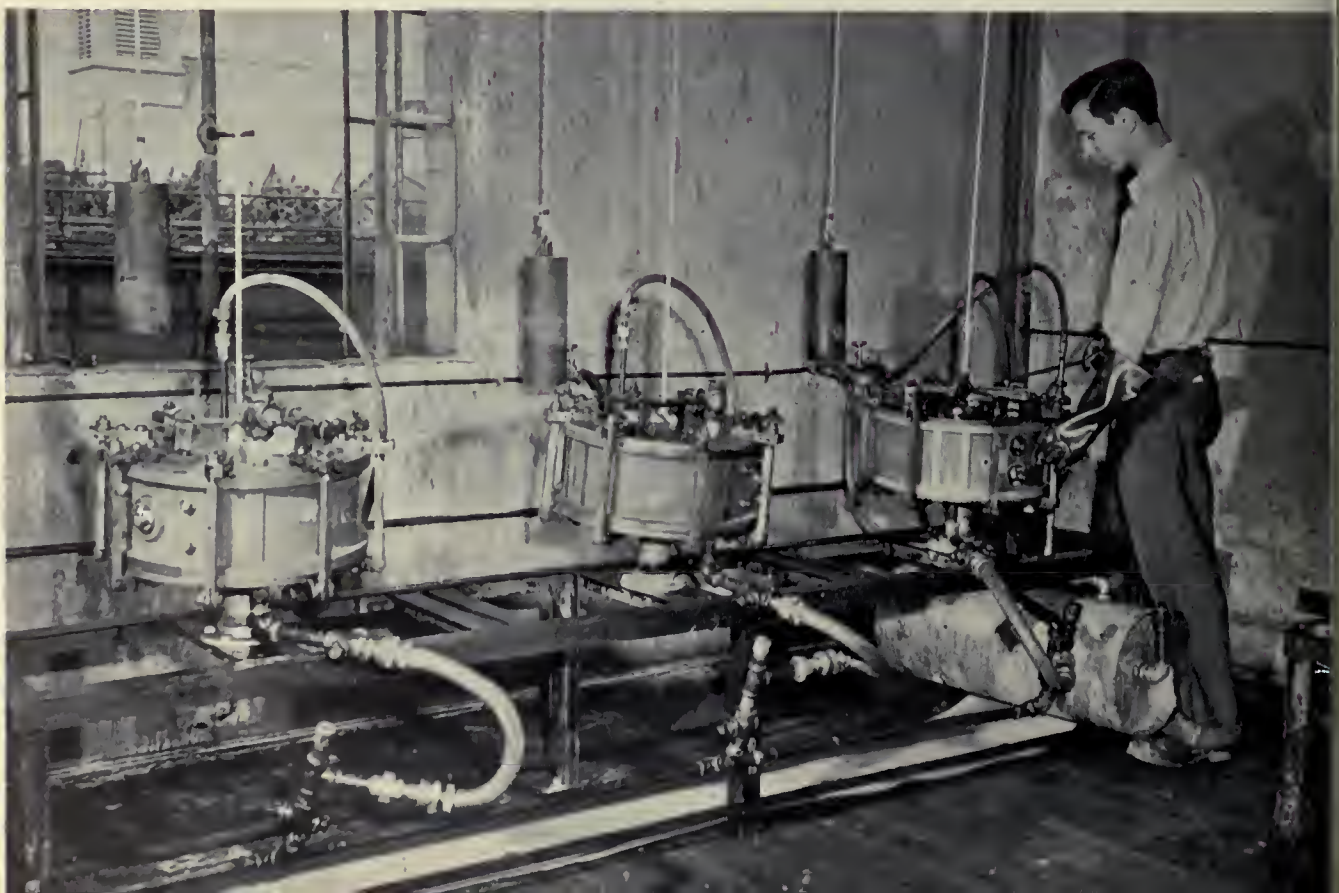
age. It is usually desirable to test with the fluid to be use later in the casting. By any of these methods, leaks are de termined in the structure of the casting itself and are re corded, and then the weak points are observed after th curing of the resin to determine whether the casting ha been made pressure tight. After impregnation, casting are inspected and retested in accordance with specification Generally, one impregation is sufficient, but it is occasion ally necessary to reimpregnate the casting in order to elim inate all pressure leaks.

Polyplastex, together with Simmonds Aerocessorie Inc., conducted an extensive study of the micro-porosity i a complicated engine control casting. The results of thi work are best indicated in the following quotation from a article in the Simmonds *Aero News*: "Prior to the devel opment of the *Polyplastex MC* impregnation procedur rejects due to porosity and leaks at one time numbere 80%. Since the establishment of the impregnation proc ess, rejects due to the causes mentioned (micro-porosity have been zero. To date, several hundred bodies have bee successfully impregnated."

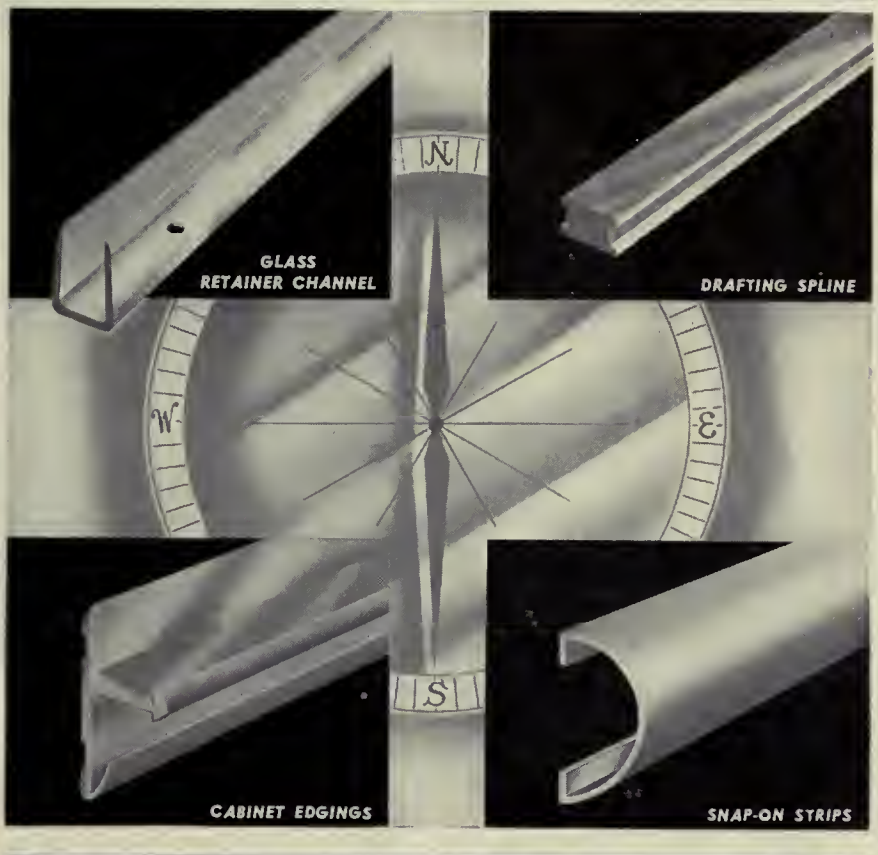
The sealing efficiency of all castings impregnated b Polyplastex has been an average of 99%. An interestin example of this efficiency is the familiar Mae West lif jacket, which is inflated by the release of carbon dioxid previously compressed in a small aluminum alloy casting In conjunction with the Kidde Manufacturing Company Inc., manufacturer of these units, such castings were im pregnated by Polyplastex, and the sealing efficiency to dat has been 99%, the castings being impregnated only once.

Other impregnation jobs handled successfully have been magnesium castings for radio and electronic equipment aluminum castings for radar devices, aluminum castings fo ordnance, bronze castings for flame throwers, magnesiu units for fire control systems, and many other importan parts, all better sealed than ever before. EN

After the sealant is forced by pressure into all pores of the metal, it is cured into a hard, insoluble material



EXTRUDED IRREGULAR SHAPES



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The foregoing description sounds like a decorator's or a homemaker's dream. All, and more, of those qualities, however, are claimed for *Varlon* Stainproof Wall Covering, newly developed by Varlon, Inc., Chicago, a division of United Wall Paper Co.

The marring of beautiful walls, ruination of expensive wall paper and spoiling of decorative schemes because of external causes has long presented a problem. Marks made by children's grubby hands or their pseudo-artistic efforts with crayon or pencil; carelessness displayed by some women in theatre or other public powder rooms, in "sharpening" their lipsticks on the nearest available wall; water stains, food or beverage spatters—these are just a few of the unfortunate things that happen to wall paper.

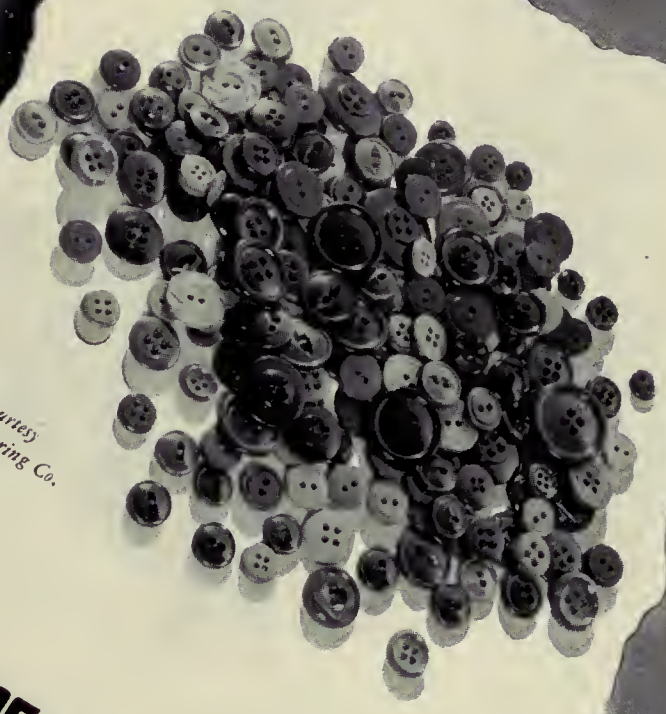
Recent discoveries by Varlon laboratories in the chemical formulation of printing materials, and a patented manufacturing method, have resulted in a product which is said to be "complete within itself." Although technically described as having a "paper or a cloth backing," the actual composition and appearance of this wall covering is such that either of its types would seem more accurately to fall into the category of an impregnation. The completed product presents the appearance and feel of fine quality wall paper and is to an extent even more flexible. It can be hung by paperhangers in the conventional manner and with no special equipment or tools other than the possible use of *Varlon* Bonding Solution, developed for the purpose, in place of standard paperhangers' paste. Even this is not entirely necessary, but is advocated by the company due to the fact that it also has the qualities of vermin-resistance, mildew- and mold-resistance, and is waterproof.

Use of such wall covering in hospitals, restaurants, hotels, offices and other public buildings would obviously possess

(*Continued on page 86*)

DURITE

PHENOLIC PLASTICS



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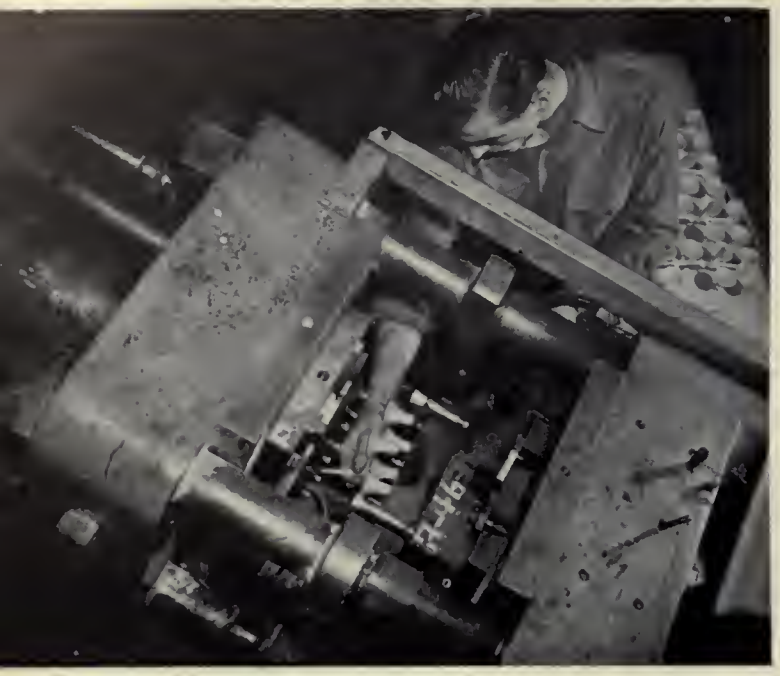
Aid to sanitation is provided in a disposable, one-use liner for six-compartment food tray. Of cellulose acetate, these liners are made by Scholl Mfg. Co., Inc.

Dorothy Gray's "Magic Hour" perfume is sleekly packaged by Vargish & Co. in fully-enclosing, bevel-edged cover and platform base of Rohm & Haas' crystal-like "Plexiglas"

alf-pint barrel of this oiler or sprayer is of transparent te," providing visibility of the liquid level within the con- , as well as durability and impact strength. Interchange- of oiler and sprayer is effected by change of nozzles and s, and the segmented design permits a firm grip. Molded by ibus Plastic Products Co. for Midwest Production Machine Co.

Important speeches made by outstanding personages and leaders during World War II have been preserved in auditory form, by Historical Recordings, in albums of durable, high-fidelity, vinyl plastics records

almost entirely of acrylate, ng four feet supporting the maple wood base, the center f a coffee table by Dorian encloses a light; flamelike ent conceals end of rod which table together. Cigarette box le is also made of acrylate



Removing bells for toy flutes from 8-cavity mold. How many cavities to use for given job is a design problem

Injection Mold Design

Part 1. Pointers on size of mold, number of cavities, economics of mold making, and various do's and don't's of mold design

By John G. Robb

WHEN designing molds for injection molding, there are pitfalls to avoid and many problems to be carefully thought out. The well-designed injection mold is one which will give trouble-free production. It also must give the desired quantity of production, and do so at the lowest cost possible.

Too often low mold cost is stressed to the point where higher production costs will be encountered because of unwise short cuts in mold making. Good mold design considers economy of die making costs, but should not let this consideration go beyond a point consistent with a quality product and economical production. The amount of production expected has much to do with the quality required in the mold.

Mold design should begin with a searching and constructive criticism of the piece design. The great majority of molded products are designed by people who at best have only a vague understanding of mold making, and of the molding process. A few minor changes made on the recommendation of the mold designer often make the difference between an easily molded product and a tough production job. Also small changes may save many hours of expensive tool room work by eliminating shapes that are difficult to machine in the steel mold block.

Often these changes are apparent to the mold designer as soon as he studies the blueprint or sample of the article to be molded. Sometimes they only come to light as the mold design begins to take shape in the designer's mind, or on the drawing board. In either case good practice requires that they be brought to the attention of the product designer, and his permission to make alterations be requested. Too often this first step is overlooked until changes become expensive when their need is discovered by the toolmaker or production foreman after many dollars have been spent on the mold.

It is not within the scope of this article to discuss piece design, as this is a subject in itself, but no one should attempt to design a mold without first becoming familiar with the molding process and toolroom methods so that he may be qualified to pass on part design. Good practice requires that a sample be made before starting a mold, and often a sample cavity should be tried before making the production mold.

The injection mold consists fundamentally of two main parts. It is run in a machine similar to one shown in Fig.

The machine has a hydraulic cylinder or mechanical toggle mechanism to clamp the halves of the mold together. After this is done, another hydraulic ram forces the plastics material into the cavity of the closed mold, thus forming the molded part. After this part has been set up, the clamping end opens and ejects the molding from the die. The injection ram has been retracted, allowing more material to be fed into the heating cylinder from the hopper.

The stationary or injection half of the mold is fastened to the platen on the injection end of the machine. In this half there are channels called sprues, runners, and gates through which the plastics material passes as it is forced into the cavity.

The moving half of the die is fastened to the clamp end platen. Into this half of the die is built a mechanism for ejecting the molded piece from the mold as it opens, and a provision for returning this ejector mechanism to its retracted position as the mold closes for the next cycle. The two halves of the die are kept in proper alignment by the use of guide pins which are pressed into one half and slide in the other. In the injection process hot material is shot into the mold and must be allowed to cool before it is rigid enough to hold its shape upon ejection. Therefore, both halves of the mold will contain channels through which cooling water can flow.

In practice, methods of gating, ejection, cavity construction, etc., vary according to the design of the piece being molded. These various items will be discussed in detail later.

Before layout work is started on the board, a decision must be made on the number of cavities to be incorporated in the design. If the production requirements are not large the correct number of cavities is arrived at by balancing the estimated cost of constructing the mold with various numbers of cavities against the estimated cost of producing the required number of pieces from the various mold capacities.

It should be obvious that mold making costs rise with

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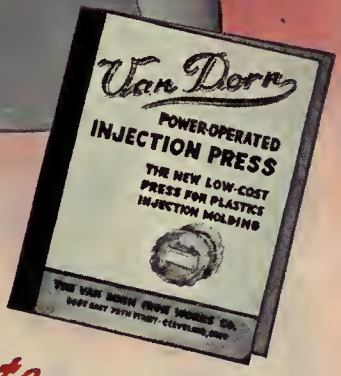

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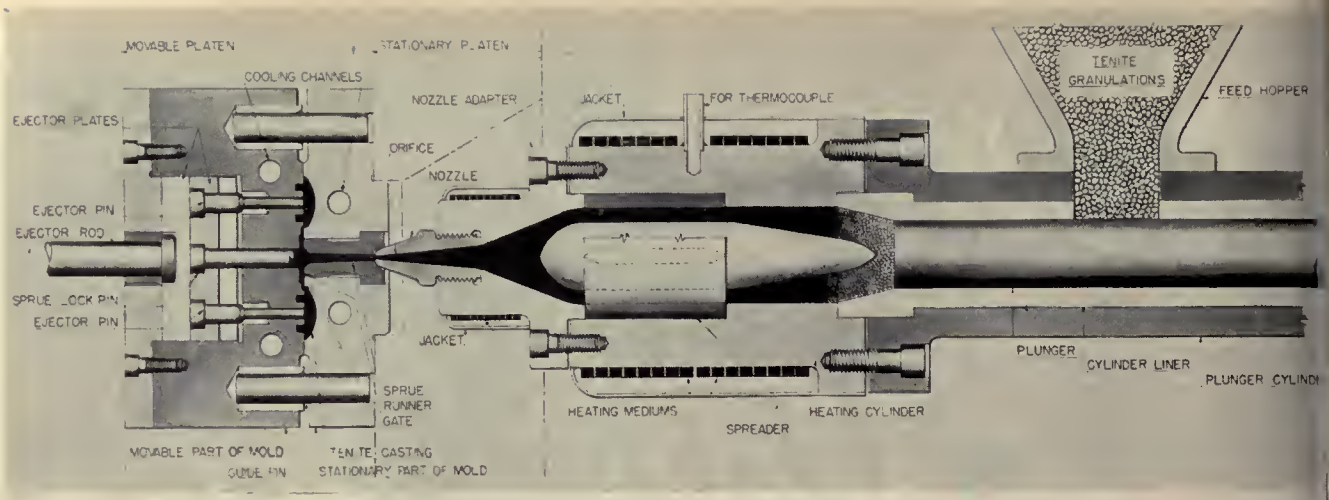

Fig. 1. Sectional view illustrating general method of injection molding (Sketch courtesy of Tennessee Eastman)

an increased number of cavities. Molding costs, however, are reduced by an increase in the number of cavities as more pieces are produced at each cycle of the machine, and additional cavities will not add materially to time of each cycle.

There can be no set rule for determining the proper number of cavities for a given number of plastics pieces. Per cavity, mold making costs vary greatly, depending on the complexity of the article to be molded, and piece price is only partially determined by the number of cavities in the mold. Material cost, finishing costs, and other items are a large factor in piece price, but are not a function of mold size. Only by balancing all these items can we determine the most economical mold size for a given number of pieces.

Comparative Costs

For example, costs for the manufacture of a varyi number of pieces in molds with 4, 6, and 8 caviti are compared. Mold costs are respectively $800, $1,0 and $1,300, and production per hour 360, 540, and 7. pieces. Other costs and selling price appear in the tal below.

	Selling Price per M		
10,000 pieces	$49 00	$43.00	$38.(
50,000 pieces	45.00	39.00	35.(
100,000 pieces	42.00	37.00	33.(

From the costs noted, the size of mold to use for each the three specified numbers of pieces may be determine

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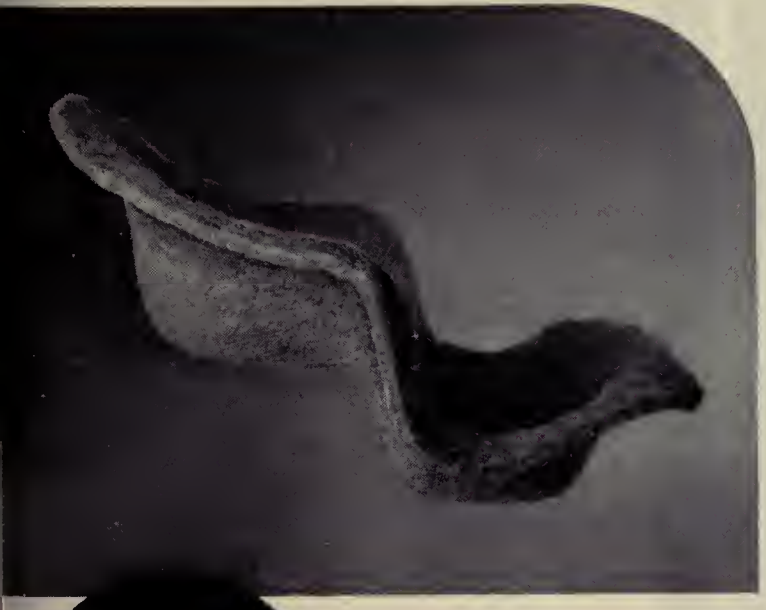

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Ten thousand pieces would cost a prospective purch
$490 plus $800 (the cost of the mold) or $1,290 when
4-cavity mold was used; $430 plus $1,000 or $1,430 for
6-cavity; and $380 plus $1,300 or $1,680 for the 8-ca
Thus, it would be most economical to use a 4-cavity r
for 10,000 pieces.

Molding and Related Costs

	Number of Mold Cavities		
	4	6	
Material (including waste)	$10.00	$10.00	$1
Molding cost per M (machine and overhead)	14.00	9.30	
Finishing	5.00	5.00	
Shipping and inspection	1.00	1.00	
Rejects (5%)	1.50	1.28	
Cost of sales	3.15	3.15	
TOTAL COSTS	$34.65	$30.73	$2

Fifty thousand pieces could be most economically mo
in a 6-cavity, and 100 thousand in an 8-cavity mold, as
following figures demonstrate:

	4-cavity	6-cavity	8-c
50,000 pieces			
Mold cost	$ 800	$1,000	$1
Selling price	2,250	1,950	1
TOTAL	$3,050	$2,950	$3
100,000 pieces			
Mold cost	$ 800	$1,000	$1
Selling price	4,200	3,700	3
TOTAL	$5,000	$4,700	$4

When production requirements are very large, it is
necessary to balance mold and production costs. U
this condition the largest mold possible is obviously
most economical, and the selection of the mold size r
entirely on the designer's knowledge of the limitation
the molding machine on which the job will be run.

Here there are four limiting factors to consider:

(1) Injection machines are rated in ounces of pla
material that can be injected into the mold in one shot.
is not advisable to go above the rated value. Theref
the weight of the material required to fill the cavi
sprues, gates, and runners should not exceed this r
weight, or the mold has been designed with too many c
tics. Most injection machines are rated on acetate. If
other material is to be used, the difference in specific gr
ity must be considered.

(2) The area of gates, runners, and cavities proje
on the parting line of the die must not exceed the r
clamping area of the press. If this is done, the press
of the injected material will exceed the clamping press
and the die will be forced apart. Material will then f
out of the cavity along the face of the die, causing rej
and possible damage to the mold.

(3) As the die layout progresses, the designer must k
in mind the die space and the location of the knock-
mechanism on the press (Fig. 2) so that the die may
fitted into the space between the tie-rods without tak
the press apart. This is sometimes a limiting factor on
number of cavities even where conditions one and two h
been met. A full scale layout of the press platen made
tracing paper is very helpful in checking the fit of
mold in the press. By laying this over the mold lay
possible interference can be seen at a glance. Items
and two require reference to the rating of the ma
found in the manufacturer's literature. Drawings of
press platen area are supplied with the machine and
used to make layout needed for Item 3.

(4) There is another important consideration, whic

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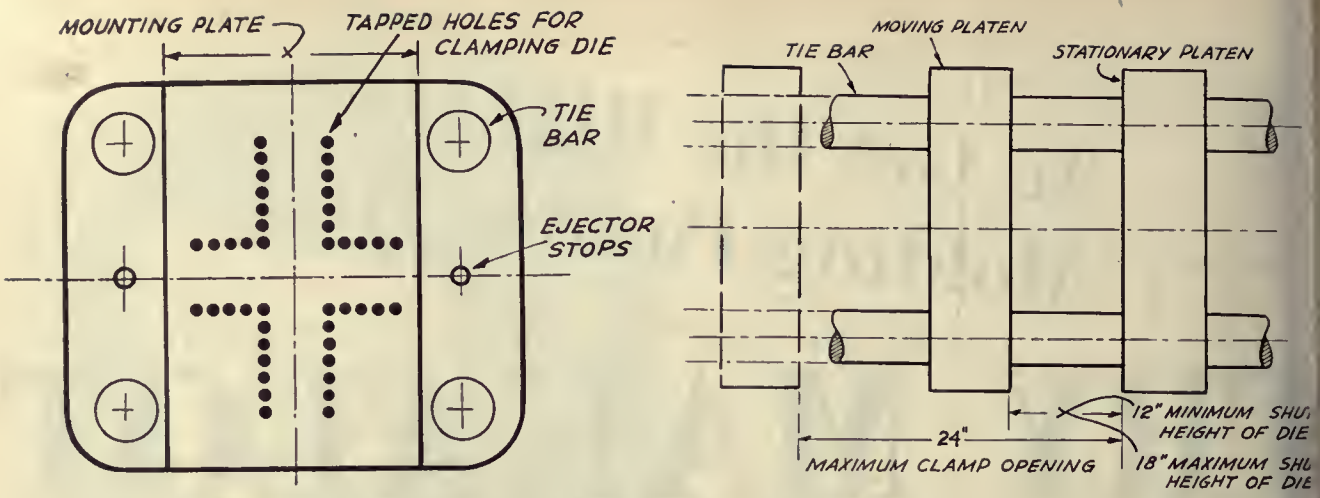

Fig. 2. At left, a typical platen layout of an injection machine. Die must be designed so that it can be placed into press either by lowering down between the rods or sliding it in front between the tie rods; the knockout mechanism of the die must be long enough to be operated by stops; and the die must be small enough to permit clamping in holes provided for that purpose. In sketch (right), height of the die when closed must not be less than the designated minimum or more than the designated maximum shut height, and die layout should be checked to be sure that there will be enough room to remove the molded pieces from the cavity or punch when press is at maximum clamp opening position

more a matter of judgment based on experience than something obtainable from the manufacturer's data sheets. These data may indicate that a twenty cavity mold is permissible from the standpoint of weight, area, etc., but some castings would never mold properly with the long complicated gating required by such a layout. This is especially true of transparent moldings such as lenses where extreme clarity is needed, and on heavy section moldings such as hair brush handles. Here, simplicity of gating is very important, and more than a few cavities will result in production difficulties which may not be overcome.

Combination Molds

Often when there is more than one plastics part in an assembly, there is a great temptation to save mold cost by incorporating two or more of these pieces in the same mold frame, giving what is commonly called a combinati

(*Continued on page* 110)

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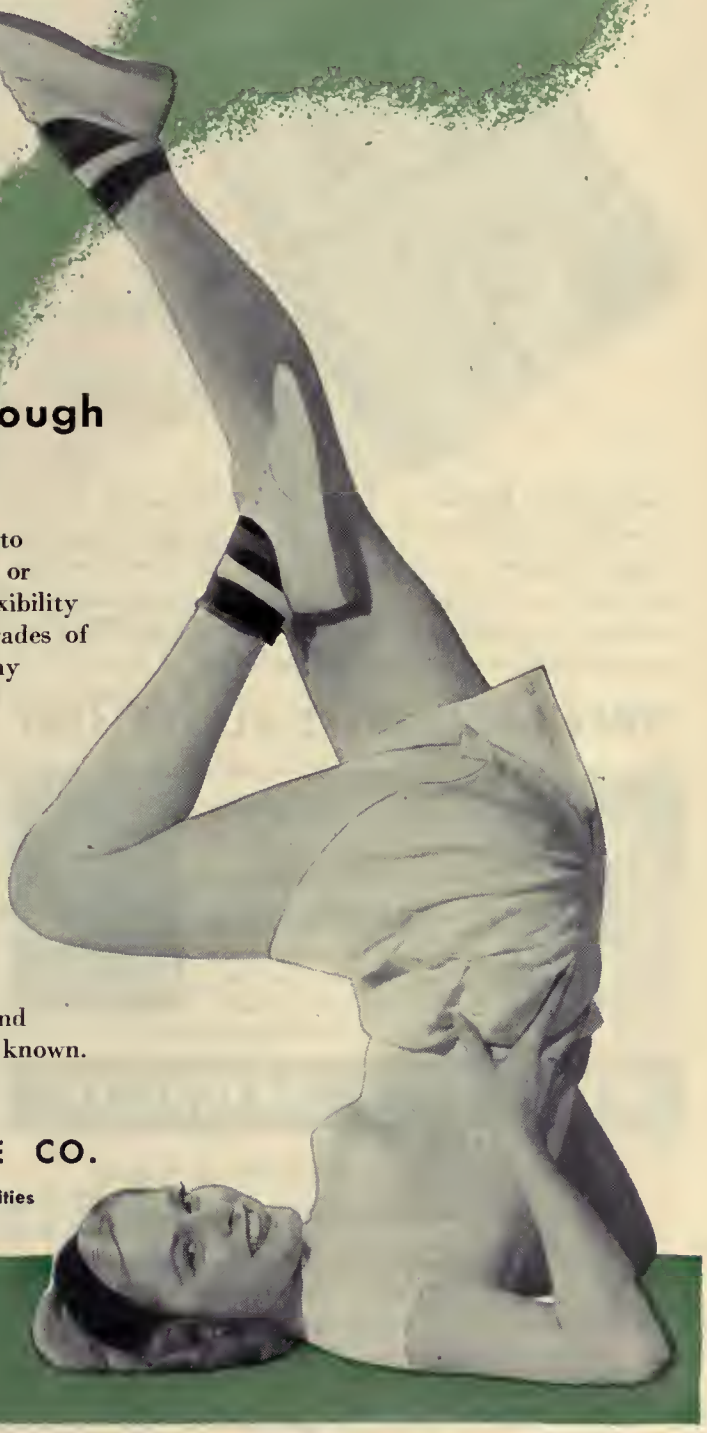

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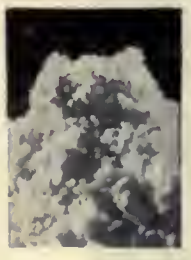

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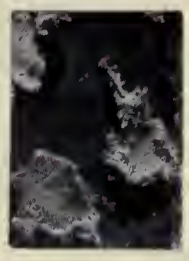

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Hobbing Ideas

Mold makers pool their opinions on metal flow, surface finishing, hob removal, and other problems

Some highly practical and useful ideas on the hobbing of molds for plastics emerged in a round table conference held recently by the SPI West Coast Technical Committee. Participating in the discussion, which was presided over by John Delmonte of the Plastics Industries Technical Institute as chairman, were Messrs. Kerseg of Diecraft Corp., Huling and Clark of Wilcox Molding Co., S. Windman and Eastenson of Windman Bros., and E. Marx, consulting engineer.

After introducing general aspects of hobbing molds, Mr. Marx turned the discussion over to Mr. Kerseg, who described the flow of metals during the hobbing process. He emphasized that the metal must be worked slowly and given an opportunity to flow. The steel being hobbed will have a tendency to heat, and unless the right type of press is used and the correct skill employed, the material may let go all at once and ruin the hob. The problem of upward and sideward flow of metal was reviewed. Flow is easiest with a hemisphere, Mr. Kerseg pointed out, though with relatively straight sides, the flow tends to go outward. By allowing the hob to push back off the face, the material may bulge in from the side, and care must be exercised to avoid rolling the metal back and producing folds in the hobbed cavity.

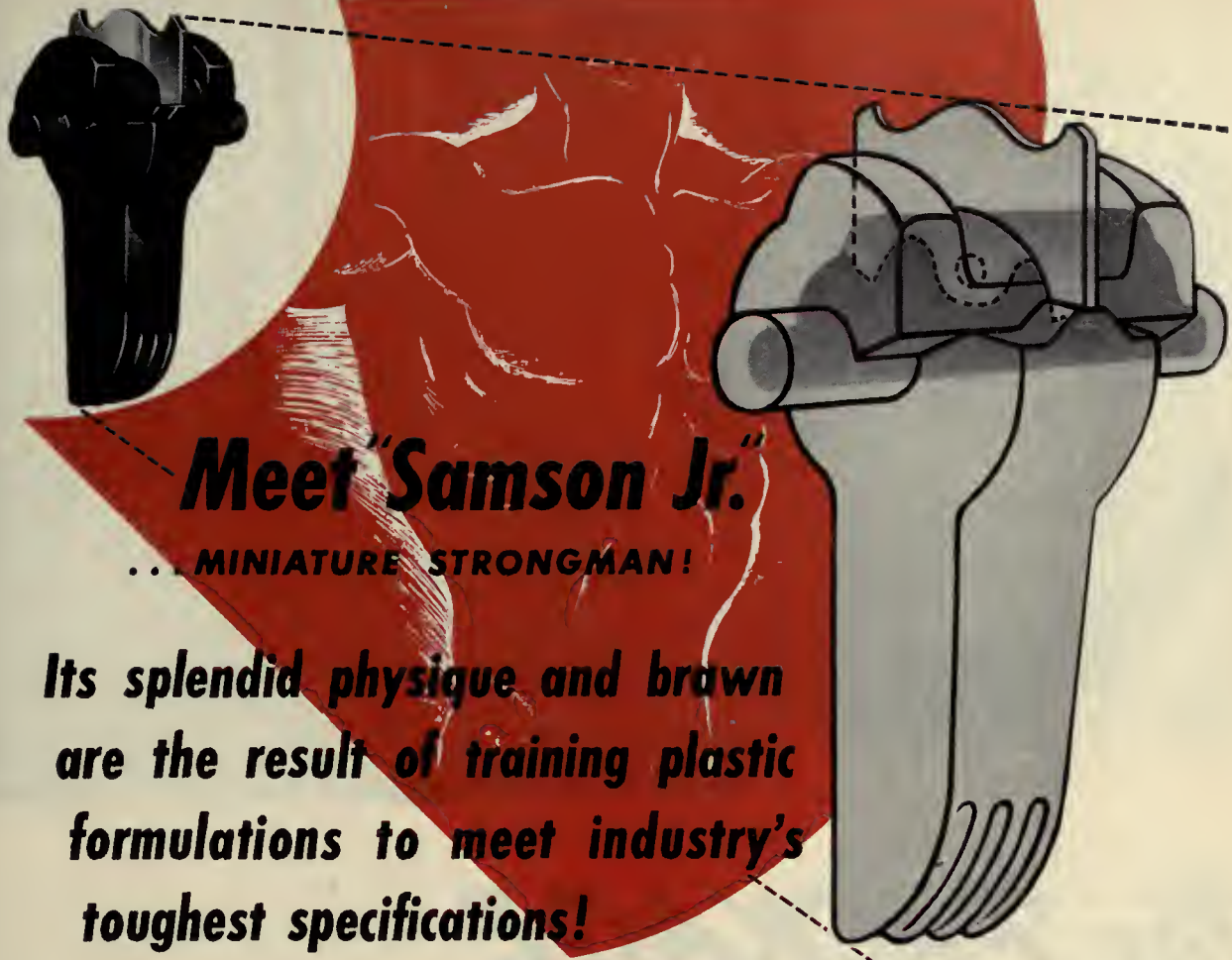
Shrink rings play an important part in controlling the flow, and Mr. Kerseg suggested a negative draft on the rings to force the material against the hob. He also recommended the use of a dummy hob on the bottom side to induce upward flow for difficult hobbing. As an example, he cited the hobbing of a die for a waffle grill, and the steps taken to relieve and remove metal from the blank to permit and control the flow of metal.

Mr. Windman and Mr. Eastenson took up the question of surface finishing of blanks before hobbing, recommending a dead flat and polished blank, buffing to a mirror finish. Inasmuch as oils will not stick to a dead hard surface, they recommended copper sulphate as the best lubricant for the hob as well as the blank. Grease may cause pockmarks on the surface if used between the hob and the blank. They emphasized the importance of experience in hobbing molds and the necessity of maintaining the correct feel for the job on hand to get the best results.

Mr. Huling expressed preference for a hard hob and soft blank in hobbing molds. He pointed out that there are two choices in selecting material for the chase rings: (1) a forged steel ring with hardened bushing, or (2) an alloy steel, such as SAE 4340. In discussing the relationship of cavity size to blank size for hobbing, he recommended keeping the blank as small as possible with respect to the hob. Mr. Clark of the same company said that he hardened the hobs to the range of C58 to C60, stating that, with alloy metals, the adhesion decreased with an increase in hardness. The correct hardness for the master hob was the subject of some debate. If too hard, fracture of the hob will result; and, if too soft, difficulties will be encountered in removing it from the blank, as the hob may yield.

Mr. Eastenson recommended that difficult projections be eliminated from the hob and that these be reproduced in

(*Continued on page* 109)



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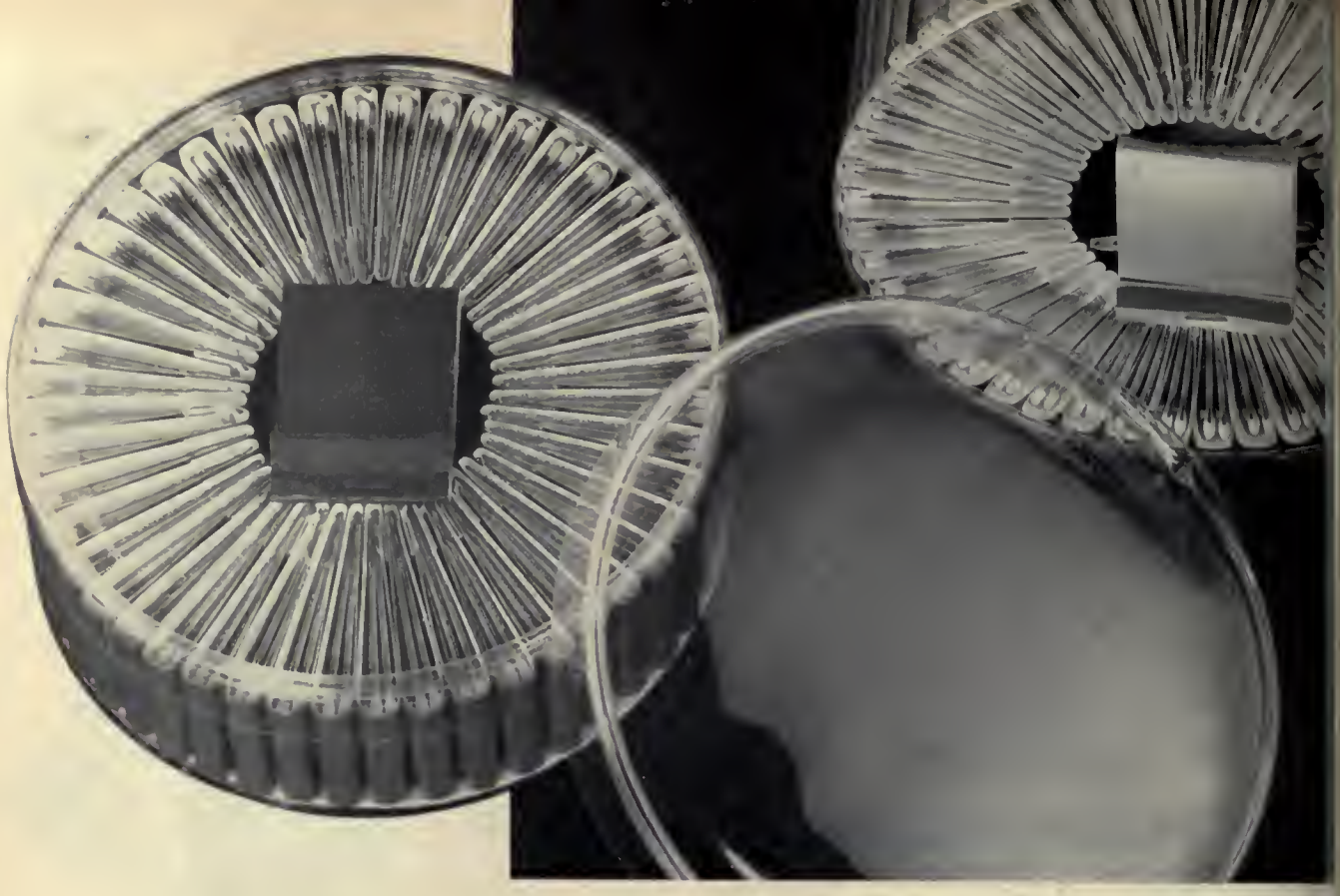


The PACKAGE —Sells the Product

Transparent cellulose acetate containers add that additional touch of distinction and sales attraction to party gifts and adornments

By Percy Barker

President, Monogram Co. of California

TO SELL most things across the counter takes more than good quality alone, important as that is. Something unusual is needed for volume merchandising, something to make the buyer say: "I want that." When the product sold is intended for gifts or adornments to a party setting in the home, the necessity for extra sales attraction becomes paramount because the purchaser is looking for a distinctive "find." To insure a rapid turnover of such goods calls for cooperation all the way from manufacturer to retailer. Our experience has been that we can best serve our customers in increasing sales by providing packages that enhance their contents. Wherever they have been tried, transparent cellulose acetate containers have given excellent returns both in merchandise and dollar volume.

The concept that the package sells the product has been fundamental in our merchandising methods. Five years ago, when the Monogram Company of California entered the market with a line of "Party Goods and Things to Monogram," we secured the best paper packaging materials available and designed boxes to show off gift and party assortments of bookmatches, napkins, coasters, and guest towels. These containers were expensively finished both on the outside and inside, and protective shipping containers were used to make sure they arrived in tip-top shape. At the present time some items in our line are still put up in this kind of package.

Before the end of our first year of operation, however, we began to study from a new angle the function of the package in relation to our merchandise. In originating the ensemble pack, combining several items, our attention was drawn again to the effect of line, color, and design on attractiveness of the whole assortment. Experiments proved that luxuriously finished matchbooks in particular could be grouped in highly ornamental and unusual designs. Part of the eye appeal came from the different effects from dif-

A specialty only recently put on the market—lipstick tissues in colored folders packed in an all-acetate container

ferent viewing angles. This feature could be of real value in store displays, and further investigation led us to believe that the ultimate purchaser would appreciate getting full advantage of such display. It furnished that extra "something" so important in gift merchandising, which must depend largely on impulse buying.

No matter how beautiful an ensemble, a conventional paper box concealed all its careful styling. So we began to search for a package to help our product sell itself. We soon found out that requirements covered more than just transparency. Films were out because removal of a few of the contents reduced the package to a shapeless jumble. The box had to have enough strength to survive shipping, storing, and handling in the home. Light weight was important, considered both from consumer convenience and shipping cost, and the material had to be at least as fire-resistant as paperboard.

Our problem was taken to an expert plastics fabricator who also had long experience in packaging. He came up with a cellulose acetate drum with a paperboard bottom, and a new item went into our catalog. The next problem we put before the fabricator was establishing volume production—fast. Our supplier did so. The match drum, which we believe to be the first product of its kind on the market, has become a sales leader.

From then on the Monogram Company has converted more and more of its line to plastics containers. Each new package is carefully worked out before it is tried. The role of the supplier is an important one. Unless quantity production of finished quality is practical, a container idea is not put into action. In such event we concentrate on redesigning the package to solve manufacturing problems and still retain a creative packaging design. A recent case is typical.

As a result of a several hundred per cent increase in the sale of matchbooks, largely attributable to the transparent drum, it was decided to package coasters in a small drum. The success of this item led to another innovation in the form of a square transparent box for 100 cocktail napkins. Logically, the next move was to create an ensemble of matchbooks, napkins, and coasters in a single transparent package. Thirty-six matchbooks and thirty-six cocktail napkins fitted perfectly into a square box, but the round coasters presented a problem. We had our supplier try out the plan of drawing a round cavity through the square top, leaving the corners flat against the napkins but providing a tight round cave for the coasters. It was beautiful all right—but costly and slow to make. So into the discard it went, and we devised a separate drum about an inch high to hold 18

Items in the Monogram "Pak" line include packs of cocktail napkins (upper left); combination pack of coasters, napkins, and matchbooks (upper right) known as the "Hostess"; and a varied assortment of other packages of similar type

coasters, the container to be welded right on top of the square lid. Production was simplified, and thus the new "Hostess Ensemble Pak" was born, which is already outselling the ensembles offered in paperboard boxes.

Although increased fabricating and materials costs have been reflected to some extent in prices, this factor has in no way interfered with sales volume. The standard party and gift sets converted to visible packages have steadily risen in popularity, frequently almost overnight. New assortments, specially styled for new containers, have taken their places along with established items. In fact, uniformly transparent packages have resulted in larger sales.

Nor can these gratifying merchandising results be attributed to novelty, which may be expected soon to wear off. Bookmatches of various sizes and colors in four sizes and styles of drums have kept pace with first expectations. To insure a certain and extensive supply, the Monogram Company of California joined forces with the Lion Match Co. on September 1, 1945—the latter firm acquiring a half interest in the business. Of about 100,000 plastics containers used per month, a large number goes for book matches alone.

A point not to be overlooked in any discussion of plastics packages for this type of merchandise is the importance of quality. The Monogram line of party and gift goods, frankly, consists of luxuries. Use of the words "Carriage Trade" and a suitable emblem in our trade mark exemplifies this theme. Although expendable, every item sold is the best that can be found. Should the container which is fashioned to show off these things to best advantage in a purchaser's home be the least bit shoddy or cheap in appearance, the whole effect would be negated.

Linking this requirement with the necessity for volume production puts a strain on the supplier. Workmanship is reflected in a smooth, sparkling, uniform bead; the absence of rough edges; seam cementing that is even and all but invisible. Care must be taken in drawing and stamping that the sheets do not crinkle, streak, or cloud. The raw material must be as nearly flawless as possible. Surface smoothness and polish have to be retained all the way from sheet manufacturer to the final gift set purchaser.

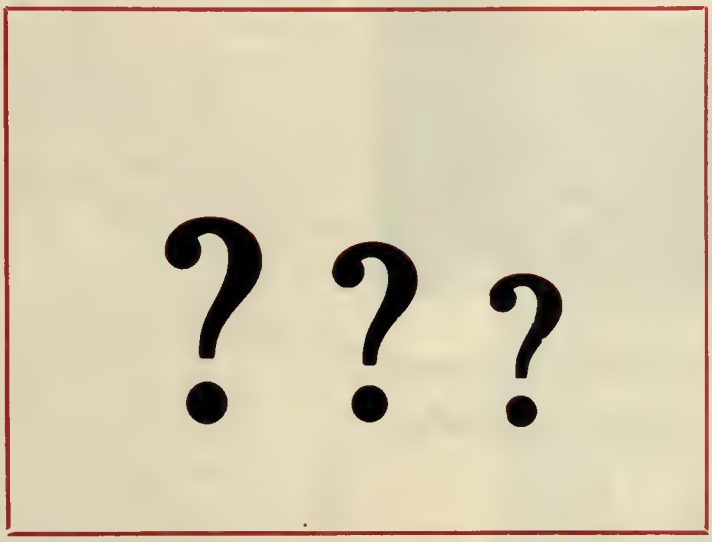
The containers, received in perfect condition from the converter, require special handling. Making up assortments is hand work. So is packing them for shipment. Special protective containers are used, and shipments are by express. Each plastics item is protected from scratching by light weight paperboard. Store managers are encouraged to retain this covering for use when wrapping an order for their customers. These precautions are not unique; we have followed the same procedure with certain paper-boxed items.

The retailer has found that displays of these sparkling, transparently protected sets help him to move not only the products so packaged but others of a complementary nature. The plastics container serves as a leader. A big advantage to the retailer is the wear and tear that visible packages save their contents. He encounters practically no loss due to customer handling. A much larger per cent of his total stock is salable at full price because of this saving and because he need not reduce the price of an item because it has been on display. Utility of the container is also responsible for part of the popularity of merchandise so packaged. This is particularly true of bookmatch drums, which serve a variety of purposes in the home after the matches are gone.

It is safe to estimate that 75% of the increase in Monogram sales can be attributed to transparent packages. The future may well see our entire line packaged in plastics. We are now working on new and eccentric shapes and studying the possibilities of combining cellulose acetate with other materials. END

MANUFACTURERS OF

COMPRESSION and TRANSFER HYDRAULIC PRESSES!



Watch for the picture appearing in this space next month

Available Now!

Our complete line of standardized designs including 50 to 575 ton capacities within a few weeks after placing of order.

A NEW SERVICE!

It is our policy to work with you on any of your problems involving compression molding with hydraulic equipment. We will assist in laying out and designing your molding room and we will supervise the installation of our presses in your plant. We will also set up your first mold and train your personnel in the operation and maintenance of our equipment.

Write Today Regarding Your Specific Requirements

GORSKI BROS.

EXECUTIVE SALES OFFICES
600 NORTH ST.
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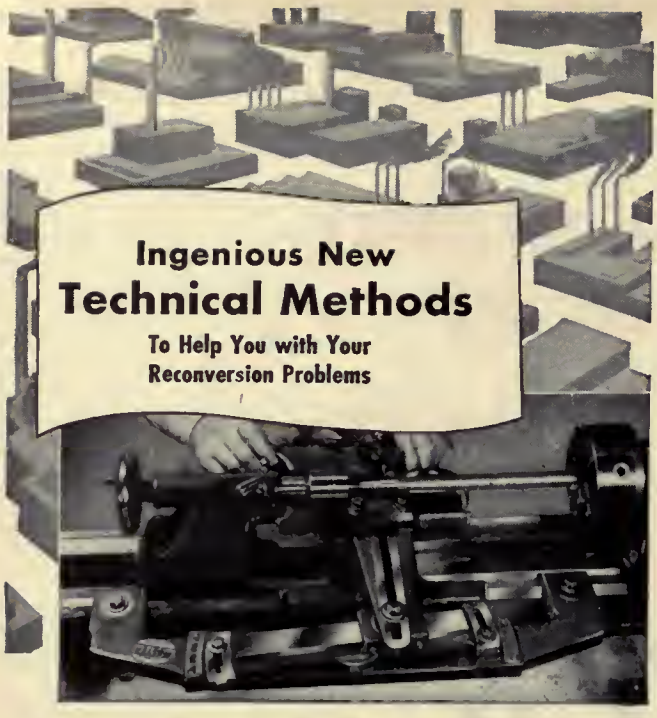
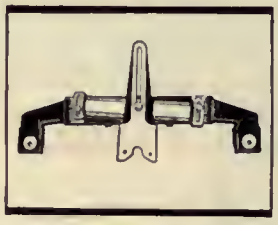


Simplified Master Taper Attachment Fits All Types of Lathes Instantly!

Now! A "universal" taper attachment that fits all lathes, old or new, big or small—that can be attached or removed in *minutes!* This taper attachment is not bulky or cumbersome. It bolts easily to the bed, in the back of any lathe.

The Master performs accurate taper turning, boring and threading with the ease of any straight line tool operation. It precisely duplicates any tapered part. Is usable in any position. Does not interfere with straight turning. The bar is precisely machined and fitted. There is no vibration. Taper graduations are in inches at one end; degrees at the other. The master is available now, in two sizes; two feet and four feet in length.



Model 710
Master Taper Attachment

Available today also, is delicious Wrigley's Spearmint Gum. This is one treat you can enjoy even when your hands are busy. And the pleasant chewing helps to keep you alert and wide-awake, even through a monotonous job.

Chewing Wrigley's Spearmint satisfies a fellow. In addition, it helps keep your mouth moist and fresh—so you feel better. And feeling better, you naturally work better. By making gum available to all, scores of plants and factories report increased morale and efficiency that really pays off.

You can get complete information from the Keene Electrical Machinery Co., 549 W. Washington Blvd., Chicago 6, Ill.

AA-64

Housing Looks to Plastics

(*Continued from page* 50)

free of dirt and allergy-producing agents. It is said that vacuum cleaning of rugs and upholstery would be avoided, except for such dust as is conveyed to the interiors upon shoes and clothing.

Formica laminates used for kitchen drain boards and work tables have established "bar top resistance" for them. The laminates are surfaced with melamine, which was adopted because of its inertness to alcohol, household cleaning fluids, and burning cigarets. The material is easy to clean and highly resistant to abrasion. Casein glue affixed the 1/6" lamination to wooden tops of built-in kitchen equipment.

Specially engineered, opaque push plates, formed of cemented *Catalin,* are employed throughout the house to control fluorescent and neon lighting. The switch plates are flat. They extend 1/16" from the wall, after a new design by Wm. W. Brockway, electronics consultant on the job. The location of each is revealed by a diffused glow, achieved through back lighting.

When lights are on, pressure upon the plate causes a relay to shut off the current. If lights are off, an identical pressure on the plate switches on the power.

Phenol formaldehyde and *Catalin* parts for coils and relays were chosen for their dielectric properties. Terminal strips and plugs to control built-in radio reception, provided in every room, are of molded phenolic or laminates, with control knobs in molded phenolic and *Catalin* cast phenolic.

A tooth powder dispenser of molded *Lucite,* designed by J. L. Day, Oakland, is in a bath room medicine cabinet. Synthetic rubber bristles were utilized in fabricating a Hall electric vibrator, also part of the bath room equipment.

Furniture, supplied by Bullock's, Los Angeles, includes several chairs for the all-purpose room, upholstered in black *Koroseal* by Comprehensive Fabrics Co., New York. Outside furniture for the barbecue is done with the same product in a white patent leather finish.

The material was utilized for barbecue chairs, because it possesses resistance to ultra-violet sun rays, weathering, and abrasion, as well as being flexible and washable.

Another application of *Koroseal* was in construction of cornices over draperies. These were padded with ordinary fabric, then covered with the plastics material. Table lamps, with *Koroseal* shades, stand in the all-purpose or play room.

Throughout the house, plastics parts and materials are employed in mechanical and electrical assemblies.

Molded polystyrene shelf supports insure stability and resistance to fatigue from heavy loads in two Servel refrigerators. One is in the kitchen, the other in the barbecue. Inside panels of the refrigerator doors are of phenol formaldehyde, coated with Du Pont's *Dulux.*

A kitchen range, produced by Western Stove Co., Los Angeles, has gas control handles of white *Plaskon* urea formaldehyde. The material was chosen for its inertness to heat transmission, as well as its cleanability and resistance to wear and rough treatment.

Phenolic knobs and insulating parts in switches are performing in a *Teletalk* room-to-room communication system built by Webster Electric. Controls for built-in radio sound equipment consist of a *Plexiglas* plate, *Catalin* buttons and molded phenolic knobs. Dial handles for a Radio Corporation of America television set, located in a niche beside the living room fireplace, are of plastics. The same applies to many parts of the radio sound equipment, as well as dial handles for a Westinghouse *Laundromat* and *Laundrodry,* both installed in the kitchen.

Television impulses are brought into the house, from an

Handles Every Preheating Job in Your Plant

THERMALL

Preheating
EQUIPMENT

A complete line for the plastics industry. THERMALL HF Heating Units handle your smallest to your biggest jobs — efficiently, economically.

The THERMALL line was created to solve specific problems which could not be met by existing equipment. THERMALL units worked overtime during the war. They are, today, solving problems of plastics molding in many of the industry's best known plants. THERMALL units are cutting costs, saving time and labor, enabling molders to handle larger, intricate moldings with relative ease.

The THERMALL Diamond means outstanding performance in HF preheating equipment. Every THERMALL unit is guaranteed for your unconditional satisfaction.

Write for practical or technical advice or a demonstration of THERMALL preheating equipment in your own plant.

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Protects
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keeps your THERMALL Unit always up-to-date. There will never be an "old fashioned" THERMALL.

The THERMALL Champ

Occupies only 20 x 30 inches of your floor space. Heats 96 ounces compound to molding temperature in 1 minute. Completely portable — weighs only 500 lbs. Mounted on Rubber Casters. Easily rolled from job to job. Exclusive THERMALL one control operation.

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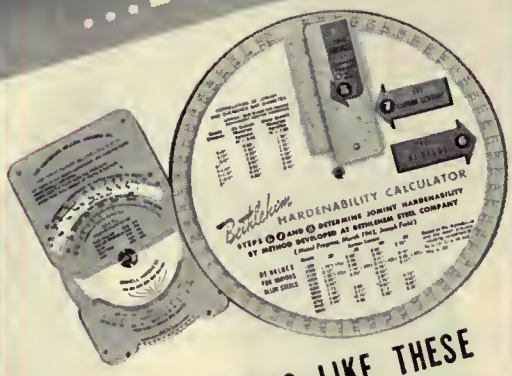
Representatives: V. S. Wagner, Trenton, N. J., Hugh J. Cameron, New Rochelle, N. Y.

Export: Omni Export Corp., 40 East 34th St., New York

TO PRODUCT IN PLASTICS BY FELSENTHAL . . . FROM BLUEPRINT

PLASTIC CALCULATING DEVICES ...BY FELSENTHAL



IN PRECISION JOBS LIKE THESE *Hairline Accuracy* IS ABSOLUTELY VITAL!

These new calculating devices solve intricate problems by the turn of a dial. Since a hairline of error might be disastrous, leading users depend on Felsenthal's precision workmanship for their calculator requirements.

Our experience and facilities in the design, development, production, and assembly of Vinylite Calculating devices is unique. We are in an excellent position to take your problem from scratch—or from blueprint or model—and follow through to finished product.

Consult our Design and Engineering Department, and write on your letterhead for our new booklet No. 3-A, showing hundreds of products in plastics—similar to those we can make to your specifications.

ARMY NAVY

FELSENTHAL PLASTICS

G. FELSENTHAL & SONS

4124 W. GRAND AVE. CHICAGO 51, ILL.

BRANCH OFFICES: NEW YORK • DETROIT

Est. 1899

FROM BLUEPRINT TO PRODUCT IN PLASTICS BY FELSENTHAL . . . FROM BLUEPRINT TO PRODUCT IN PLASTICS BY FELSENTHAL

outside antenna, by way of a flat tape transmission line consisting of two parallel wires, enclosed in a protective polyethylene coating. This plastics inhibits moisture penetration, and at the same time is highly flexible.

Telephones, specially designed by Western Electric Co are in an unusual warm gray. The color was obtained by mixing yellow, burnt sienna, white, black, and blue ingredients into the *Lumarith X* cellulose acetate.

On the lawn, plastics materials play their parts at night. An unusual lighting effect was achieved by utilization of *Lucite* and *Plexiglas* in fabricating vari-colored filters through which a clear white illumination sprays upon shrubbery and rooted plants.

Both sheets were cut into parallel strips and dyed in old shades of red, green, and purple by Raymond De-Icer Co Los Angeles. The strips then were edge butted, and fitted to 12″ flood lamps.

Light from these devices superimposes and mixes to intensify natural colors of foliage and blooms. Minimum consumption of electrical current is a characteristic of this plastics application.

For its wide utilization of new materials, its unusual architecture, and the introduction of mechanical and electrical household equipment, the post-war structure has established itself as a Los Angeles show place. It occupies Wilshire Boulevard location, valued at $75,000. Large numbers of prospective home builders have been attracted to study the innovations. EN

Plastics Glazing

(*Continued from page* 34)

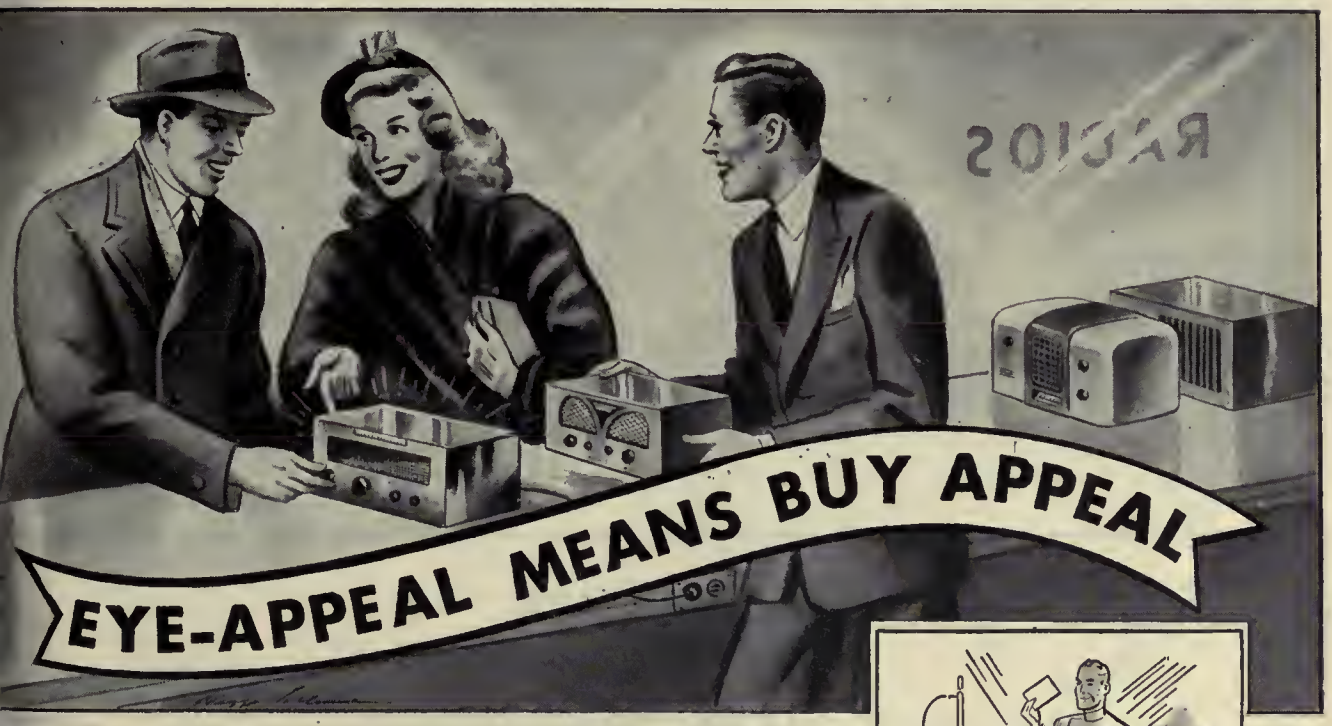
greater flexibility, and has the ability to be self-fitting because of a tendency to contract slightly. Its extremely high bursting strength of 165 psi is only 35 psi below that of the wire-reinforced *Vimlite*. Like the original product, it can be cut with an ordinary knife or household scissors and fitted to frames by tacking.

The new Celanese glazing is now being utilized in a 3′ by 3′ cold frame which constitutes a complete planting unit that comes ready for simple set up. The seed bed, called the *Sun-Gro Seedling Bed*, is believed especially adaptable for the summer developing of perennials. It has a frame work of wood lacquered white to reflect the greatest amount of light and heat, and its construction incorporates such conveniences as a swivel brace on the inner front of the box which allows the sash to be raised six inches and hooked in place for necessary ventilation, and a two-inch tilt for complete rainwater drainage. Already available in parts of the East, it is scheduled for wider distribution as soon as more materials are forthcoming. EN

Delicate plants obtain necessary protection with "Vimlite"

Codur

. . . THE FINAL TOUCH OF PERFECTION THAT MAKES PLASTICS SELL FASTER!



Plastics look their best, and sell fastest, when they have the added surface beauty of a very fine finish like CODUR.

CODUR is a line of high-gloss, synthetic baking enamels especially designed for a one-spray coat application on molded (phenol formaldehyde) plastics. They have excellent color retention and bake to a very hard mar-resistant surface. CODUR is available in most colors in plain enamels and many metallic colors. M & W also offers air-drying or baking finishes for other plastics: acetates, butyrates, methacrylates and others.

SERVICE THROUGH RESEARCH AND EXPERIENCE

Whatever the material, simply submit a sample of your plastic and we'll recommend the proper finish. 70 years' experience and our fine research facilities are at your service. Contact any of our offices.

PIONEERS M.&W.Co. 1876 IN PROTECTION

MAAS & WALDSTEIN COMPANY NEWARK 4, NEW JERSEY

658 Carroll Ave., Chicago 12 · 6 Jersey St., Boston 15 · 1228 W. Pico Blvd., Los Angeles 15

PRODUCERS OF LACQUERS, ENAMELS, SYNTHETICS AND SPECIAL PRODUCTION FINISHES

Wall Covering
(*Continued from page* 64)

numerous advantages, its qualifications for the home being equally important. Its foremost attributes would undoubtedly lie in its washability and durability. A variety of substances such as grease, oil, lipstick, crayon, furniture polish, and others, have been deposited on *Varlon,* in tests, allowed to remain over a period of time, and then removed with soap and water, leaving no trace. If, as may sometimes occur in the case of lipstick, crayon, or certain inks, a slight stain remains, this is quickly eliminated by means of a light, rapid sponging with turpentine.

25,000 revolutions in a washability tester, using a 4-lb washing pad, soap, and water, produced only a slight gloss.

The plastics resins which are combined in *Varlon* are, in addition to being stainproof, inherently resistant to mildew, mold, vermin, steam, and water. They provide a product which is also non-flammable and high in resistance to abrasion and tearing. All of the components of *Varlon,* it is said, are thoroughly tested and inspected for the qualities which they must contribute to the finished product.

The material in its finished form has been subjected to a number of rigid tests to determine not only the aforementioned advantages, but various others as well, including those of reaction to climatic changes, color-fastness, impact strength, flammability, etc. As the result of these tests, its makers are now prepared to claim for *Varlon* a number of interesting qualities. In determining its reaction to temperature changes, a test sample of the product was removed from a temperature of 160° F, which it had undergone for 30 days, and chilled suddenly to —50° F, with no resulting disintegration or other harmful effect. Exposure to 100% relative humidity at 120° F, for a per of four days, also failed to produce any adverse results.

A 48-hr fadeometer test, cited as being equivalent tc yrs of normal use, is said to have shown no fading of material. Although it is required to cut as easily as or nary wall paper, with shears or knife, in test panels and walls it is claimed to exhibit no tendency to chip un sharp, hard impact.

Salt water test over a period of 24 hrs on a specimen *Varlon* left no stain or other ill effect, and a 6-hr, li stream-spray test is also said to have left no visible eff on the test sample.

A sample of *Varlon* exposed to flame striking direc on its surface for 5 min, showed no tendency to flammal ity, and glowed for no more than 10 sec after removal the flame which had been used in the test.

Mildew and bacteria tests conducted over a period of hours on the material produced the expected growths, wh were removed with soap and water, leaving no mark injurious effect. And when butted seams of *Varlon* w covered with a standard, vegetable base cooking fat, for hrs, wiped dry and washed with soap and water, no st or other visible effect remained.

The company advises that results of these tests, c ducted in the Varlon laboratories, have been corrobora by means of field tests and by customers who have u the product in homes, hotels, restaurants, etc.

The range of color and design in which *Varlon* can produced is extensive, and the company plans to market product in units, or packages, of 100 sq ft, 50 linear ft, wide, to each package, at a probable minimum price of per sq ft. Distribution outlets, according to present pla are to be department stores, decorators, and a selected nu ber of paint and wall paper shops.

It's A Sure Thing With

Martindell

When It Comes **To PLASTIC MOLDING**

A consultation with Martindell takes the guesswork out of your plans for that new product. You can then be sure that the material chosen will be suited to the job, and that molding difficulties will be anticipated and provided for. The Martindell Organization, when it takes over actual production, has the "know-how" and experience to put it through on time and right.

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NEW YORK OFFICE—1182 BROADWAY

Plastics PHENOLIC • UREA • CELLULOSE ACETATE MATERIALS

"CALLING DR. WALTERS"—

This madern haspital equipment made fram Plaskan—a melamine material—is molded by Watertown far the Stondard Electric Time Compony of Springfield, Mass. This is commanly used far utility raams, diet kitchens, nurses stations, etc. The equipment is regularly furnished with one, twa, three, ar four lamps and con also be equipped with a buzzer ond cutaut.

Watertown, molders far aver 30 years, are equipped ta hondle oll thermasetting and thermaplastic moldings as well as finishing ond assembly. Consult Watertawn engineers on your plastics problems. The Watertawn Monufocturing Campony, Watertawn, Cannecticut. Branch affice—Cleveland. Soles offices—New Yark, Chicogo. Detroit, Milwaukee ond Howaii.

Watertown

A NAME AS OLD AS THE PLASTICS INDUSTRY

WHAT'S *New* IN PLASTICS

Optical Micrometer

Aireon Mfg. Corp.
166 W. Olive Ave., Burbank, Calif.

Developed to meet important gaging requirements of plastics manufacturers and those using plastics or glass in their fabrication work, the *Aireon* Optical Micrometer is said to permit accurate gaging of transparent plastics, and glass, in curved shapes and in inaccessible spots.

It is scaled to .001", has an acrylic nosepiece 2" in diam and 3" long, thimble diam 1.5", and weighs less than 1 lb; operates on two scales, from 0.0" to 0.4", and from 0.4" to 1.5".

Ease of operation and speedy, direct, and accurate readings are listed among its qualities, and it is constructed in such manner as to prevent its scratching or damaging plastics optical surfaces.

Use of this micrometer in measuring thickness of such plastics units as acrylic windows for airplanes, and in similar instances, is said to have fulfilled an important need.....(510)

Special Magnet

Eriez Mfg. Co.
Erie, Pa.

Announced as a special addition to the standard and *Jumbo* line of magnets made by the company, a new, "non-electric plastics magnet" is being introduced by this company for installation in the aluminum or steel chute (below the measuring cylinder) on injection and extrusion molding machines. It is said to be the first special plastics magnet designed for installation on individual plastics molding machines.

Eriez units are described as possessing lightness of weight and flexibility of design which facilitate their being installed in difficult positions on machinery.....(511)

For Larger Moldings

Lester-Phoenix, Inc.
2711 Church Ave., Cleveland, O.

A 32-oz injection molding machine which is said to have a superior injection system includes among its features a one-piece steel frame, a newly designed toggle linkage, and a larger mold adjusting screw.

An internally heated torpedo serves as the primary heating element, in addition to the three external resistance type heaters. A heat control instrument in each of the four heating units provides maximum plasticizing capacity and flexibility of control. More material is said to be delivered into the mold at higher pressure, with a given energy output, by this vertical injection system than with any other type of injection cylinder. Resistance to flow is minimized, and the company promises faster plasticization, faster cycling, denser moldings with a better finish—all at lower cost.

The cross-sectional frame area is 240 sq in, with an ample opening in top of frame for lowering dies or molds. No joints, greatest possible rigidity and strength, less wear and tear and upkeep, longer machine life, and better moldings are distinguishing advantages of the one-piece cast steel frame.

Supported corners speed mold openings and closings. They prevent flash, increase die space, and cut cycle time to a minimum.

An enlarged mold height adjustment screw at the center and at the outer perimeter supports the movable platen, thus eliminating platen deflection.

Precise control of injection speed, resulting in high gloss and absence of flow and shrink marks, is obtained by a special flow control circuit. Hydraulic ejection after the mold is fully opened permits deeper molds, a shorter cycle, and "softer ejection." Safe operation is insured by the new safety gate which is interlocked hydraulically, electrically and mechanically.....(512)

Poppet Type Check Valve

Greer Hydraulics, Inc.
454 18th St., Brooklyn 15, N. Y.

Light weight, simplicity, no moving parts except for the poppet and positive opening and closing action are among the qualities claimed for this new poppet type check valve.

The unit is comprised of a valve housing, an aluminum alloy poppet guide, a valve spring, and a retaining ring. A 50,000 cycle test, fully open to fully closed at 2000 psi, is said to have produced no appreciable wear on either the poppet or the seat .....(513)

For High Speed Sawing

Wyzenbeek & Staff
838 West Hubbard St., Chicago 22, Ill.

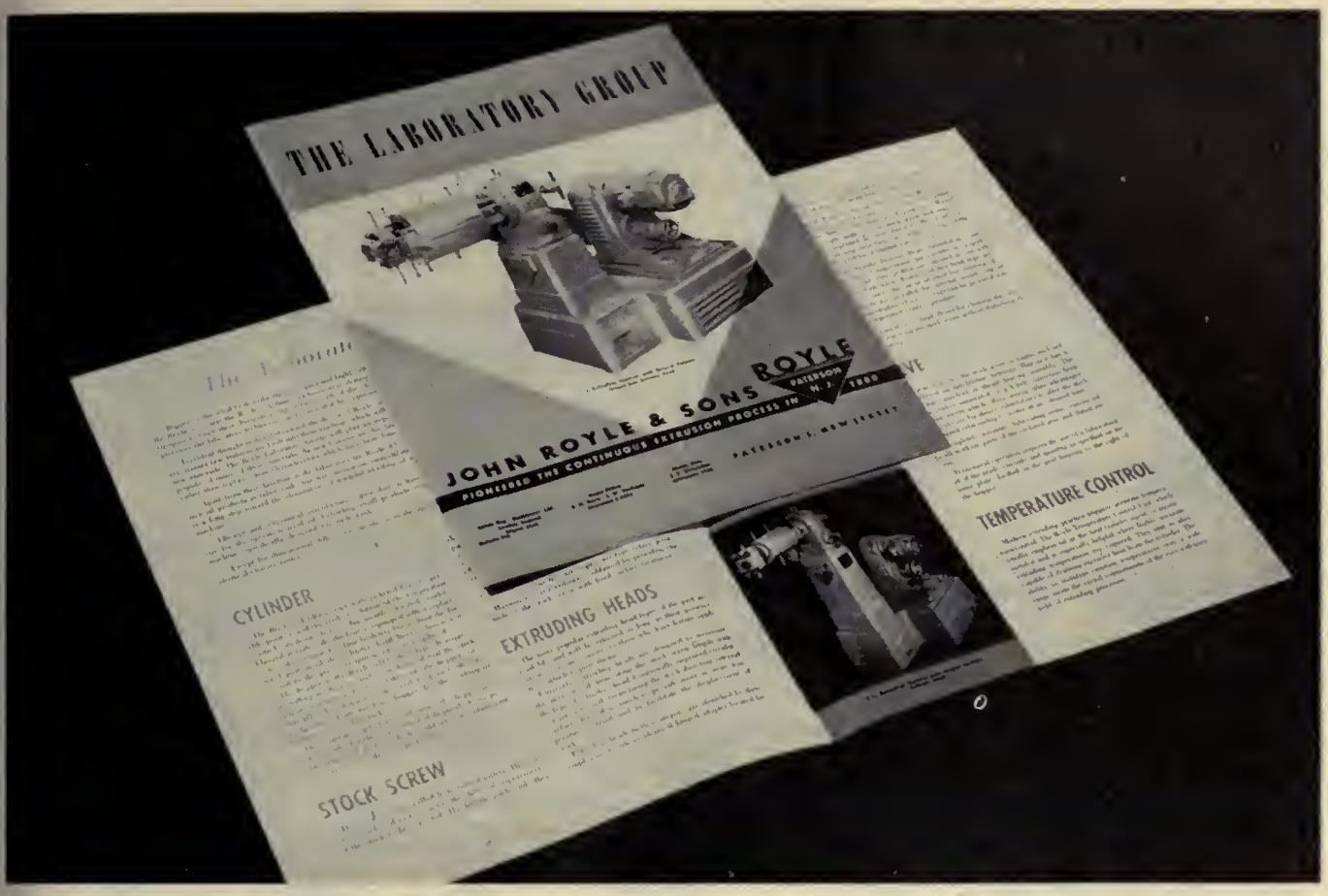
Described as embodying "all of the features of today's development for fast and dependable work," this new unit is called *Wyco Hy-Speed* Saw. It can be attached to any ¼" electric drill, air drill, or flexible shaft, for sawing and filing plastics, metal, or wood, and, according to its makers "will cut anything that a hack saw will cut;" it uses ordinary hack saw blades, and standard ¼" shank machine files, and chucks in drill chuck or collet.

Design and construction of this new-type saw are said to make it exceptionally easy to use in difficult places, with absolutely true sawing assured by new square plunger with takeup for wear.

Various other features are listed for the product, including lightness of weight, absence of gears or cams, etc.; all rotating parts are ball-bearing; wearing parts, heat-treated.....(514)

In rapidly-moving times such as these, keeping up with every latest development in one's field is a "must." In order to simplify for our readers the task of obtaining detailed information regarding the new products, processes and trade literature described herein, *plastics* has keyed each item in this section with a number, and has provided the name and address of the manufacturer or producer of each.

Mention of the key number, and of the issue of *plastics* in which the news item appeared, will serve as quick identification of the product when writing the individual manufacturer or producer for further details.



SEND FOR THIS BULLETIN—IT'S FOR YOU

THE LABORATORY GROUP—fresh from the press—will tell you why the Royle #½ and the Royle #1 are the extruding machines you will want to know more about when you plan for the busy years ahead. In an entirely evolutionary manner features have been built into these extruding machines which will secure successful results with the ever lengthening list of extrudable compounds.

Whether your plans involve research or light product extruding THE LABORATORY GROUP bulletin gives you the basic data you will require . . . If you plan a program of research you will find that these extruding machines have the characteristics for heavier product extruding. . . . If you plan a program of light product extruding you will find it more profitable to use an extruding machine specifically designed for such work.

Send for your copy of THE LABORATORY GROUP and let it suggest to you how these extruding machines—Royle #½ and Royle #1—can meet your specific requirements.

JOHN ROYLE & SONS

ROYLE — PATERSON N. J. — 1880

ARMY NAVY

PIONEERED THE CONTINUOUS EXTRUSION PROCESS IN

James Day (Machinery) Ltd.
London, England
REgent 2430

Home Office
B. H. Davis J. W. VanRiper
SHerwood 2-8262

Akron, Ohio
J. C. Clinefelter
UNiversity 3726

PATERSON 3, NEW JERSEY

Literature Review

Pyrometers in Plastics Production

Cambridge Instrument Co., Inc.
3014 Grand Central Terminal, New York 17, N. Y.

A recently-issued 12-page bulletin, *No 194-SA*, illustrating and describing the company's roll, extension, mold, and needle model surface pyrometers, also shows typical applications of each.

Standard ranges for each model are listed, and there are various illustrations and data concerning the use of pyrometers in a wide range of production operations in plastics and related industries .....(515)

Pumps and Stirrers

Eastern Engineering Company
New Haven, Conn.

The first new literature on its small pumps and laboratory stirrers printed by this company since the start of the war, this catalog contains complete descriptions and illustrations of many of its new models. Both those for regular industrial use, and the special types recently developed, are described in detail in this 20-page booklet .....(516)

Concerning High Vacuum

National Research Corp.
100 Brookline Ave., Boston, Mass.

The Vacuum Engineering Division of National Research Corp. offers a 24-page booklet dealing with the subject of high vacuum, which it describes as a "precise new tool for industry."

Providing for the first time commercial applications with pressures in the range of .000001 to 1 mm *HG*, high vacuum is believed to have unlimited possibilities in industrial applications.

The booklet is titled "High Vacuum for Industry," and covers such phases as research, testing, vacuum engineering and production, vacuum testing, etc. It is photographically illustrated and contains information and details of interest, a section on elements of a high vacuum system, and a section of useful relations and tables in high vacuum techniques.

While stressing the point that it is not, in itself, new, the explanation in the booklet brings out the fact that the availability of high vacuum in industry for commercial applications will constitute a new development.....(517)

Control Instruments

The Bristol Co.
Waterbury 91, Conn.

Bulletin *No. pH1302* describing this company's line of pH control instruments has been announced.

Bristol Continuous pH controllers and recorders are described in detail in this bulletin, electrode assemblies and accessories being included. Engineering and technical information relative to pH theory and measurement will also be found in the bulletin.

Various actual installations are described, and there are charts, records, photographs, and flow diagrams.....(518)

Milling and Grinding Catalog

Cincinnati Milling Machine Co. &
Cincinnati Grinders, Inc.
Cincinnati 9, Ohio

A carefully planned and prepared catalog combining information on these milling machines and grinding machines, attachments and accessories.

File-size, the catalog supplies details, lists specifications, and is fully illustrated throughout with photographs of machines, attachments, and certain applications.

There is a section on milling, one on broaching, one on cutter sharpening, and one on grinding—lapping. Each section is adequately indexed in the "Quick Index" at the front of the catalog .....(519)

PLASTICS SCRAP CENTER

CELLULOSE ACETATE • CELLULOSE ACETO-BUTYRATE • POLYSTYRENE • METHYL METHACRYLATE • POLYVINYL RESINS, ETC.

BOUGHT & SOLD

SELL US YOUR THERMOPLASTIC SCRAP . . . rejected molded pieces or obsolete molding powders.

We seporote combined plostics scrop material as well os remove metols ond foreign particles.

We specialize in custom grinding, magnetizing, and separating.

Our reconditioned molding powders ore corefully processed and delivered ready for use.

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AS AN artist brings dead white to life with gleaming black strokes, the sparkle of Grigoleit black trims will enhance the beauty of your product . . . harmonize with any color combination . . . often add the final "stand-out" touch of luxury.

Many manufacturers use Grigoleit black handles, knobs and pendants on vital controls to make them easily distinguishable. These and other manufacturers have depended on Grigoleit for 19 years to furnish the newest, most beautiful trims for their products.

We offer a "standard" line of handles, knobs and other parts for stoves, furniture and appliances, plus a large variety of closures for foods, drugs and cosmetics.

We also maintain a complete custom-molding service in thermo-plastic and thermo-setting plastics. Our own metal and tool shops enable us to perfectly blend plastics and metal.

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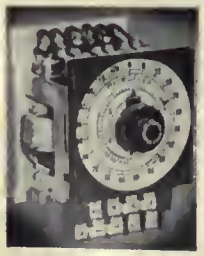
THE GRIGOLEIT COMPANY

DECATUR 80, ILLINOIS

CONTROL PANELS *for* Injection Molding MACHINES

Timing and heat controls for injection molding presses can be consolidated on a single custom-built Eagle control panel.

Each panel is engineered to the purchaser's requirements. Recommendations and quotations on control equipment will be given without obligation upon receipt of full particulars.



THE MICROFLEX is the ideal timer for plastic molding. The large Micrometer dial may be accurately set for short or long molding cycles.

Write for Bulletin 295 describing the new HA series Microflex.

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MOLINE, ILLINOIS

EAGLE Signal Corp.
MOLINE ILLINOIS

Statistical Data

Bureau of the Census presents new monthly series on use of plastics

As pointed out in *Plastics in Perspective* last month, in t latter part of 1945 the Industry Division of the Bure of the Census, Department of Commerce, inaugurated a seri of monthly releases, "Facts for Industry," Series M19H, co ering the shipment and consumption of plastics and synthe resins. Statistics were then issued for June and July, a figures for later months have since been published.

The Bureau of the Census has for several years released i formation on "Cellulose Plastics Products," but the new seri represents the first time the Bureau has presented data on t other types of resins and plastics.

With the exception of the cellulose plastics products, moldi materials, and vinyl sheeting, figures are shown on a dry bas The data for these three classifications stand for total weigl including plasticizers, fillers, and extenders. The other vin resins are shown on the basis of resin content. The data th differ from the annual statistics compiled by the U. S. Tar Commission, which are gathered on a resin content basis.

The figures shown by the Bureau of the Census represent t quantities shipped and the quantities consumed in producin plants. Consumption refers to the quantities of plastics a resins manufactured and used by the reporting company company division, and the shipments data represent the quant ties shipped by the reporting companies to outside users or non-producing company divisions or subsidiaries. Althoug the shipments and consumption data are called for separate on the report form, they are combined for the purposes of th report.

Plastics and Synthetic Resins Consumption

Item	Shipments and Consumptic (lb.) December 1945	Novembe 1945
Cellulose acetate and mixed ester plastics[1]		
Sheets		
Continuous (under .003 gauge)	438,251	568,08
Continuous (.003 gauge and upward)	375,691	645,27
All other sheets, rods, and tubes	351,159	446,9C
Molding and extrusion materials	5,394,508	6,171,0C
Nitrocellulose plastics[1]		
Sheets	828,232	899,08
Rods and tubes	460,780	598,55
Phenolic and other tar acid resins		
Laminating (dry basis)	2,047,659	2,141,7C
Adhesives (dry basis)	468,617	542,18
Molding materials[1]	9,378,740	9,613,35
All other (dry basis)[2]	2,866,455	2,334,60
Urea and melamine resins		
Adhesives (dry basis)	2,167,585	2,358,10
Textile and paper treating (dry basis)	516,983	465,46
All other (dry basis)[2]	361,677	262,12
Polystyrene	2,239,477	2,104,74
Vinyl resins		
Sheeting and film[1]	1,325,870	1,134,89
Textile and paper coating resins (resin content)	1,058,465	1,102,03
Molding and extrusion materials[1]	4,793,349	4,813,62
Adhesives (resin content)	347,221	328,99
All other (resin content)[2]	525,886	478,57
Miscellaneous plastics and resins		
Molding and extrusion materials[1,3]	4,112,445	4,110,97
All other (dry basis) [3,4]	1,480,227	1,891,83
TOTAL	41,539,277	43,012,1C

[1]Includes fillers, plasticizers, and extenders. [2]Excludes data for protective coating resi [3]Includes data for ethyl cellulose, urea and melamine, acrylic acid, and miscellaneo molding and extrusion materials. [4]Includes data for petroleum resins, acrylic acid est resins, mixtures, and miscellaneous synthetic resin materials.

COULD THIS BE YOUR HOUSE?

Now that the war's over and a lot more civilian goods are on the market, it's a big temptation to spend just about all you make, and not put anything aside.

But to fall for that temptation is plenty dangerous. It's like trying to live in the house above—a house that might come tumbling down about your ears at the first little blow of hard luck.

Right now the best possible way to keep your finances in sound shape is to save regularly—*by buying U. S. Savings Bonds through the Payroll Plan.*

These Bonds are exactly like War Bonds. Millions of Americans have found them the safest, easiest, surest way to save. The U. S. A. protects every dollar you invest—and Uncle Sam gives you his personal guarantee that, in just ten years, you'll get *four dollars back for every three you put in!*

If you stick with the Payroll Savings Plan, you'll not only guard against rainy days, you'll *also* be storing up money for the really important things—like sending your children to college, travelling, or buying a home.

So—anyway you look at it—isn't it smart to buy every single U. S. Bond you can possibly afford!

SAVE THE EASY WAY... BUY YOUR BONDS THROUGH PAYROLL SAVINGS

ZIFF-DAVIS PUBLISHING COMPANY

★ *This is an official U. S. Treasury advertisement—prepared under auspices of Treasury Department and Advertising Council* ★

plastics overseas

The British plastics industry's current contribution towards progressive relaxation of Britain's austerity standards is undeniably still retarded to a considerable extent by the shortage of essential raw materials, lack of skilled labor, worn-out equipment and congested factory space.

Another obstacle in meeting the prevailing vast demand for all kinds of plastics consumer commodities is the acute shortage of designers and design consultants with experience in the plastics medium.

In fact, Sir Stafford Cripps, Britain's President of the Board of Trade, is so perturbed by the absence of flexible, inventive and up-to-date British design craftsmanship, that he recently entrusted the Council of Industrial Design with the task of promoting, co-ordinating and accelerating the training of young designers capable of applying modern methods to such materials as plastics.

Forthcoming Exhibitions

Long-range British plans aimed at eliminating out-of-date, slipshod or "hit-or-miss" commodities are also tied in with the "Britain Can Make It" exhibition, to be held in London in July. It is being organized by the same Council, with the intention of demonstrating to the world at large Britain's capacity to produce well-designed goods in quantity.

Another exhibition, scheduled to take place at about the same time, is to show the enormous potentialities of plastics as constructional materials for re-equipping Britain's homes.

Titled "Plastics in the Modern Home," this exhibition will comprise a wide range of new and unusual types of molded interior fittings, fixtures and accessories, plastics-sheathed panels, partitions and wall coverings, as well as plastics piping, and plumbing fixtures.

A special feature of the exhibition will be a display of easy-to-clean plastics and plastics-aluminum furniture units designed with the dual object of saving space and increasing comfort in the home.

New British Plastics Laboratory

Still another step in putting plastics in the forefront of Britain's prosperity drive is a great plastics laboratory approved for building, as a matter of first priority under the joint sponsorship of the British Research Association and the Department of Scientific and Industrial Research.

Attached to this laboratory will be a pilot-plant to enable the trying-out of experimental techniques, equipment, and processes before large-scale production of newly discovered materials is embarked upon.

The staff of the new laboratory will consist of high-grade scientists and experts who will have full freedom to probe into any long-term, by-product problems which may arise during investigations.

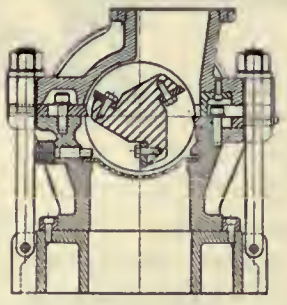
Discovery and Experiments

Experts of Imperial Chemical Industries working in close cooperation with scientists on the Vickers-Armstrong staff, in Burrow-on-Furness, claim to have discovered the "perfect plastics."

Without disclosing either its name or composition, the inventors maintain that this plastics will revolutionize many branches of industry.

The only information available about the new plastics substance, to date, is that it is of much lighter density than wood; floats; looks and feels like candle wax, is unbreakable, non-flam-

Cumberland Plastics Granulating Machines



Compact cutting chamber provides a new degree of "INTENSIVE CUTTING"

Designed expressly for granulating plastic materials, Cumberland Plastics Granulating Machines provide exactly the type of "intensive" cutting needed for tough plastic materials. Compact cutting chamber; short, rugged knives; small cutting circle—these and numerous other features combine to give Cumberland Machines superior performance. Made in 4 sizes; No. ½ machine illustrated at right.

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Dept. B—Box 216, Providence, R. I.

mable, heat-resistant, waterproof, absorbent, and can be sawed like wood.

Another plastics now being experimented with in Britain is a virtually indestructible, waterproof textile fabric made from wool, rayon and acetyl staple which may well prove a boon to textile industries everywhere.

The fibres of this material are coated with an invisible translucent film, composed of minute particles of plastics resin so twisted that on contact with water they immediately swell, making the fabric waterproof without, however, stopping the passage of air.

Silicone Production

Silicones are soon to become available in Britain in limited quantities.

Small-scale production of one group of these versatile resins has already started on a semi-commercial basis; nevertheless, for the time being, output will remain strictly reserved for research and similar purposes.

Prosthetic Devices

The British Ministry of Pensions is planning mass production of a plastics hand, invented by J. H. Simpson, a North Ireland surveyor.

This device for the use of disabled people is manipulated by remote control exercised by slight movements of the body and enables a wearer to use a knife and fork, hold a pipe or cigarette, write, use a golf club or tennis racquet, pick up objects from the floor or do almost anything else normally done by hands.

The first post-war plastics eyes of British design and make are now being manufactured on a commercial scale.

Plastics contact lenses, too, are being made available to the British public in large quantities and at about a quarter of their former price.

This price reduction has been made possible by the molding of lenses in standardized shapes and the elimination of the necessity of taking impressions of individual eyeballs for grinding optical dimensions correctly. END

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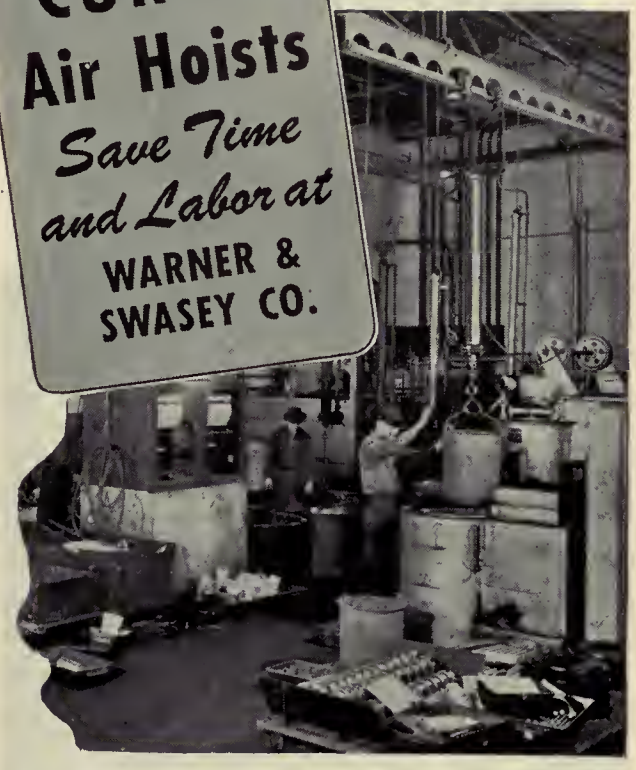

Curtis Air Hoist used in operating the Cleveland Tramrail System in the heat-treating department of Warner & Swasey Co., Cleveland.

It's another example of a well-known company relying on Curtis air-operated equipment to speed production, save time and labor, too. Curtis Air Hoists offer the following advantages to any company concerned with any lifting, pushing or pulling operation:

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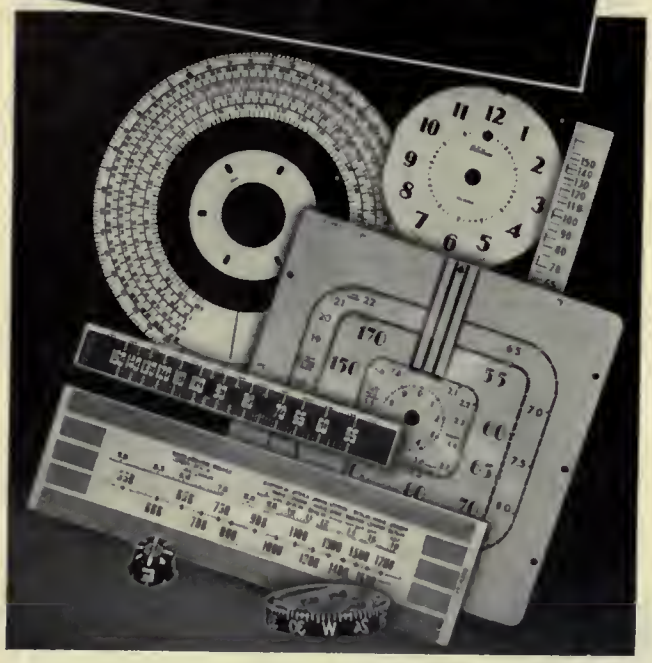

Quality, not quantity, is the tradition at Sillcocks-Miller.

Of course, we cannot make all of the plastic dials industry requires, so we concentrate on producing only the best.

That's why design engineers who need plastic dials fabricated to close tolerances have come to depend on Sillcocks-Miller craftsmanship through the years.

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SPECIALISTS IN HIGH QUALITY, PRECISION-MADE PLASTICS FABRICATED FOR COMMERCIAL, TECHNICAL AND INDUSTRIAL REQUIREMENTS.

PROBLEMS in *plastics*

Problems and questions may be submitted to this department for answering by the technical editors or specialists in the industry.

We understand there is a plastics-coated tubular steel bein used for guard rails in buses. We would appreciate your advisin whom to contact for information regarding this product.

J. A. C., Ravenna, Ohi

The Tennessee Eastman Corp., Kingsport, Tenn., displayed plastics-coated steel tubing at the recent SPE Show in Detroit. We suggest you get in touch with them.

* * *

We are interested in obtaining a plastics material having th following characteristics and requirements: resiliency, dimen sional stability, will retain its shape and yet conform to the botton surface of the human foot; it must be rubber-like, and available in about four degrees of firmness. It should be light-weight capable of withstanding the deteriorating effect of foot perspira tion, and be available in a choice of colors.

The top surface which will contact the foot or the stocking must have a surface smoothness that will permit the foot or the stocking to slide over the material without causing the produc to move forward in the shoe.

We also have a price consideration. J. J. M., Santa Ana, Calif

While "Vinylite" would seem well suited to your needs, it is possible to make a lighter and stronger product by the molding of laminated plastics, if the economics allow amortization of expensive molds. We recommend you discuss your problem with custom molders and representatives of the plastics raw materials producers, who are located in your area.

* * *

Burning or discoloration of our finished products, caused by a variation in temperature of four or five degrees, is giving us considerable trouble in the extrusion of light shades of vinyl stripping. Can this be avoided? N. R., Brooklyn, N. Y.

This is a common difficulty and can only be prevented by the closest control of all manufacturing conditions. We recommend consultation with your raw material supplier; and checking of the temperature control on your extruder, which should be a "modern" machine. From there on, just plain old-fashioned "trouble-shooting" by an expert is indicated.

* * *

We should like to have a considerable number of plastics boxes, approximately 3"×7"×2" deep. In view of the difficulty of having a mold made up in short order at present, can you refer us to some company which has stock molds for such boxes?

L. P. V., New York, N. Y.

No stock molds for producing boxes in plastics materials are presently available, either in the size you specify or in any standard size. The cost of such boxes would be prohibitive for ordinary packaging purposes due to high mold cost and comparatively high price of the material itself, taken in conjunction with the difficulty of arriving at any sizes which might conceivably be standard for articles of such quality that they would warrant a high price container. Actually, the type of box you have in mind is being fabricated at the present time. Automatic machinery for forming such containers has also been devised.

INDUSTRY HIGHLIGHTS

Again being produced in quantity after a wartime absence from the market is B. F. Goodrich Co.'s Koroseal beverage tubing, widely used in refrigerated mechanical beer systems, in wineries, and by soft drink companies. Among the advantages listed for this product are its non-absorptive qualities; flexibility; resistance to deterioration, sunlight, strong corrosives, water and oxidation.

Deseribed as an important postwar innovation in this field is *Flametone* translucent *Koroseal* tubing, through which the flow of the beverage is plainly visible.

Establishment of the Fashion Design Academy, Tallahassee, Fla., has been announced by its director, Robert Delson. Instruction courses at the school will be in the field of creative design and its branches.

An experimental molding department has been established by Grayhill, Chicago. The company advises that it is now equipped to mold small phenolic pieces on a low production basis of two to three thousand of a unit per year, enough to supply parts for pre-production runs and salesmens' samples while a large production mold is under construction.

The recently-acquired and remodeled plant of Plexon, Inc., in Greenville, S. C., is to be devoted exclusively to the production of *Plexon* plasties-coated yarn, being equipped with new high-speed machinery which will increase production by 400% to 500%, it is said.

Said to prevent adhesion to any type of non-porous mold, a new liquid mold lubricant has been announced by Polyplastex, New York City. It is designated as Polyplastex *Releasing Agent 595*, light in color, easily applied, quick-drying, and will not stain the plastics, according to its description, which adds that it has been used with marked success for contact pressure laminating and easting operations.

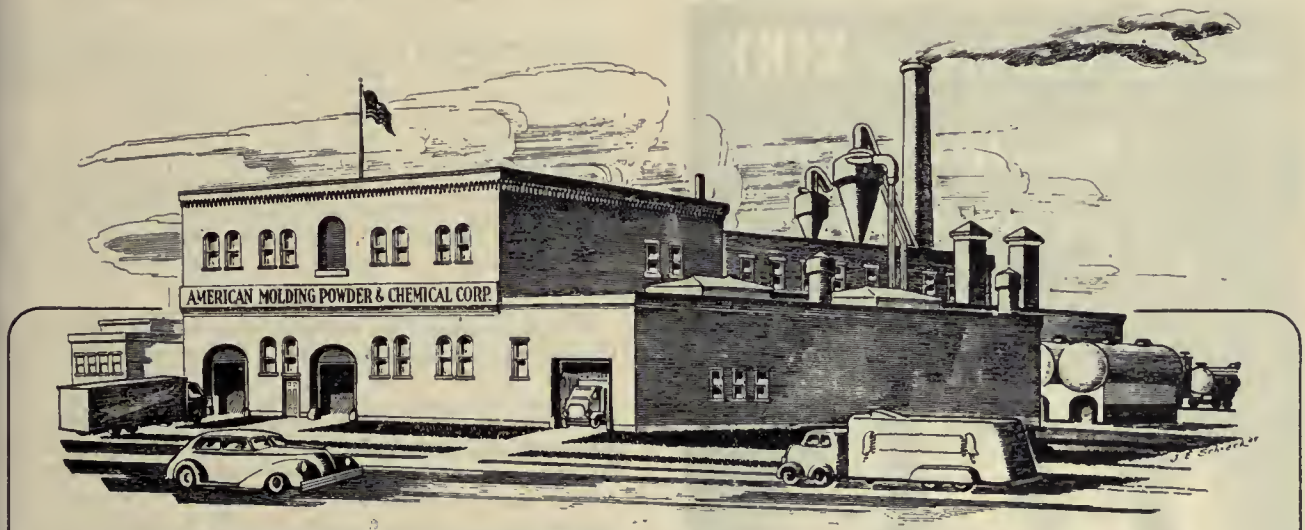
The Airtronics Mfg. Co. has moved its national sales headquarters from 31-28 Queens Blvd., Long Island City, N. Y., to larger space at 24-20 Bridge Plaza South, where the company will have more adequate laboratory and service facilities. K. V. Tindall is in charge of operations.

A new, high frequency bonding machine, developed by the Singer Sewing Machine Co., was exhibited in the booth of Dow Chemical Co. at the 1946 Packaging Exposition, Atlantic City, April 2 to 5. It will, according to description, bond practically all thermoplastic materials, either calendered or east, on the market today.

The unit is self-contained and free from static or generation of heat in the machine head, fitted with attachments for producing binding, hemming, and half lap seam felling. Material is fed by a continuous wheel feed, and passes between two electrodes that fuse it into a continuous bond. Heat is generated within the material, rather than being externally applied, thereby accommodating materials that cannot endure directly applied heat, as well as many films susceptible to shrinkage under direct heat.

No larger than a sewing machine, this unit is well adapted for assembly line procedure, and its makers expect to have it in production in the near future.

Organized to handle preparation and sale of its chemicals and provide assistance to users of *Palestic*, the "plastics gypsum"



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Among the other excellent products from our laboratories are Annealing Compound (Acrylic Cement), Laminating Dyes (Colored Cement), New Sensational "GAM CO" Buffing Compound—will not burn.

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CLINTON, MASSACHUSETTS

recently introduced by Engineering Associates, St. Charles, Il the formation of Palestic, Inc., has been announced. The hea quarters of the company are at 316 N. Laflin St., Chicago.

Offices and plant of Prince Industrial Plastics Corp. ha been moved from 7400 Stanton Ave. to 8107 Grand Ave., Clev land. Operations at the new location have been expanded injection, compression, and transfer molding of plastics, th company advises, as well as in mold design and mold makin

Organization of Anesite Co., 1959 Fulton St., Chicag has been announced by its principal, William L. Hess, who ac vises that the new company will specialize in extruded therm plastics. Mr. Hess' experience in the plastics industry has bee extensive, and he is at present vice chairman of the nation professional activities group of the SPE, and a director of th organization's Chicago section.

An expansion program which will more than double th manufacturing facilities for *Geon* polyvinyl resins has been an nounced by W. S. Richardson, president of B. F. Goodric Chemical Co. These facilities, he added, are "part of a long range plan to enable users to keep pace with their expandin requirements." Stating that a portion of the new output woul be available during the summer of this year, Mr. Richardso said that the balance of the facilities were expected to be i production in 1947.

Development of a new, unsupported vinyl plastics fil which can be embossed without the use of supporting fabri bases, has been announced by the Pantasote Co., Passaic, N.

This new film, known as *Pantex,* has been successfully em bossed in a variety of grainings, according to D. G. Higgin plant superintendent of the company. The absence of sup porting fabric or paper base contributes to freedom from pos sible roughness caused by any unevenness of base, and ease cutting, tailoring, and fabricating permits a number of unusu and intricate designs.

Primarily developed for use in women's shoes, handbag belts, and trim for fashion accessories, the applications *Pantex* are being extended to upholstery, decorative wall cov erings, book bindings, and a wide range of similar items.

Additional space has been acquired by the industrial desig firm of J. Gordon Lippincott & Co., New York City, to hous the organization's product development division, at 518 Fift Ave. The main office remains at 500 Fifth Ave.

The opening of a new branch office in Trenton, N. J., ha been announced by C. J. Harwick, president of Standard Chem ical Co., Akron, O. The new offices, with complete warehous facilities for serving the middle-Atlantic States area, are locate in the Broad St. Bank Bldg., and are under the management o M. E. Davis.

A new construction material, described as "somewhat i the nature of a plastics composition," and having among its com ponents soy bean protein and wood wool "excelsior," has bee announced by Research for Industry, Cleveland. According t Dr. Waldemar Dietz, executive director of the organization, thi new product, known as *Excelite,* will solve a problem for many manufacturers who cannot at present obtain sufficient materials Said to possess relatively high strength, low conductivity o heat, and good resistance to fire, *Excelite* is inexpensive, can b pressed into sheets or molded into a wide variety of forms, and has a comprehensive range of applications, advises Dr. Dietz

Plans for expansion of facilities of the Naugatuck Chemica division of the United States Rubber Co., "to transform the knowledge of chemicals gained during wartime into products of increased quality for industrial and civilian use," have bee announced by Herbert E. Smith, president of the company.

Construction of eight new buildings, all of which are expected to be in operation before the end of 1946, is included in the expansion program, ground having been broken in April for a new, modern laboratory and a new pilot plant which, when completed, will increase such facilities at the chemical division by more than 50 per cent. Production of new plastics "with almost unlimited industrial and commercial applications," are part of the program, says Mr. Smith.

PEOPLE

At a recent meeting of the stockholders of the Despatch Oven Co., Minneapolis, **A. E. Grapp** was elected chairman of the board of directors, and **H. L. Grapp** to the office of president and general manager. **C. P. Doherty** has been made factory manager, and **Lloyd Johnson** succeeds him in the position of factory superintendent.

* * *

J. C. Stone, vice president of Tennessee Eastman Corp., has been elected a director of the corporation at a special meeting of the board of directors, to fill the unexpired term of Eugene Chrystal, who died on March 15.

* * *

Appointment of **William I. Burt** as vice president-Manufacturing, and **Dr. Frank K. Schoenfeld,** vice president-Technical, of B. F. Goodrich Chemical Co., has been announced by W. S. Richardson, president.

Sam L. Brous has become manager of sales development for the company, and **M. Scott Moulton** has been promoted to the position of technical service manager for *Geon* thermoplastic materials.

W. I. Burt

Dr. F. K. Schoenfeld

G. W. Frick

J. W. Spiker, president of the Carbide Die & Mold Co., Pittsburgh, has advised of the appointment of **George W. Frick** as executive vice president and director of the company's sales.

* * *

Barrett L. Crandall, director of public relations of the Society of the Plastics Industry, has been elected vice president of the New York Forge of the American Public Relations Association. The aim of this organization is to maintain high standard in the field of public relations under a strict code of ethics.

* * *

William F. Newton has been appointed manager of market research and development for the Columbia Chemical Division of the Pittsburgh Plate Glass Co., according to announcement by W. I. Galliher, executive sales manager for the division.

* * *

Everett Foster, president of Basic Manufacturers' Sales Corp., recently announced that **David A. Coulter** would rejoin the firm as vice president and director of marketing.

* * *

Recently appointed vice presidents of the Casein Co. of America, Division of the Borden Co., are **H. P. Fell** and **C. S. Leonardson;** both have also been named members of the directing board of the Casein Co., as has **Nils Anderson, Jr.,** who was appointed a vice president in 1945.

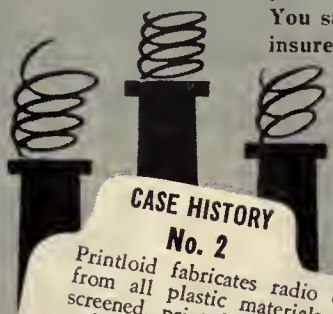
* * *

Several promotions in the plastics division have been announced by Celanese Corp. of America, as follows: **Harold L. Sheppard** was made manager of the company's new plant in Belvidere, N. J.; he has been succeeded as assistant manager of the Newark plant by **Harry Cooper,** whose previous position as superintendent of the manufacturing department, Newark, has been assumed by **Frank T. Van Dyke; Charles J. Eckert** has become production superintendent at the Belvidere plant, and **James R. Kennedy,** plant accountant; and **Albert G. Binder** has been named purchasing agent of the Newark plant.

complete plastic production...

all under one roof

From design through final assembly, experts at Printloid handle your complete plastic job in one plant. You save time and money, insure better design and uniform engineering control. Consult Printloid *first* on your plastic problems.



CASE HISTORY No. 2

Printloid fabricates radio dials and windows from all plastic materials. Here are a silk-screened, printed and formed dial of Vinylite and an edge-lit dial engraved on Lucite. Complete supervision by Printloid—of course.

FORMING

Radio Dial windows are a Printloid specialty, and we have made millions for the country's largest radio manufacturers. Printloid has worked for every industry, producing finished products as well as sub-assemblies.

PRINTING & DIE CUTTING

All types of printing on plastic — from line cuts to four color process — are yours at Printloid. Die cutting facilities range from steel rule dies to hydraulic presses for heavy plastic sheets.

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Printloid is experienced in precision work to .001". Typical of our complete machining facilities is 2½ inch through spindle lathe capacity.

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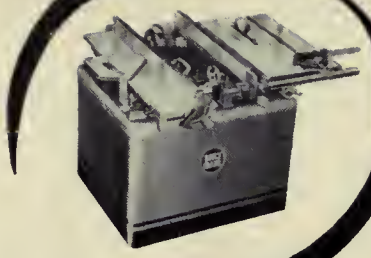

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association activities

SPI Pacific Coast Section Conference and Exhibit

"Plastics—Today and Tomorrow," formed the theme of the third annual Spring Conference, Pacific Coast Section, Society of the Plastics Industry, and the Plastics Exposition, opening concurrently with the Conference, at the State Exposition Bldg. in Los Angeles.

The Conference, on March 26 and 27, was highlighted by technical panels conducted by able technicians in the field.

Sponsored by the SPI Pacific Coast Section in conjunction with the State of California, the Exposition, which was opened to the public on March 26, was scheduled in its entirety for from six to eight weeks, with portions to be retained as permanent displays in the State Bldg. Described as being in no sense a trade show, its purpose is an approach to plastics "from the standpoint of interpreting the industry to the public," showing the use of plastics in the home, in industry, in education, science, medicine, and in various other aspects. Horace Blackman is chairman of the exhibit committee.

An industry preview of the Exposition was held on March 25, the eve of its opening to the public.

Product Tests Topic at Plastics Club

The Plastics Club of the United States was addressed at its meeting on April 9, at the Hotel Pennsylvania, New York, by Ephraim Freedman, director of the Bureau of Standards of R. H. Macy & Co.

Speaking on "Plastics: The Need for Correlation of End Use and Product Tests," Mr. Freedman stressed his conviction that plastics products should be designed to fulfill the specific requirements of the conditions under which they are to be used. In wartime, he said, the Services sent technicians into the field to observe conditions under which equipment would have to function, and products designed with such research beforehand, stand up under laboratory test to a greater extent than products which are designed merely to fill a market demand or to meet a specified price.

SPE Cleveland Section Activities

The April meeting of the Cleveland section of the Society of Plastics Engineers was planned as a Rubber Symposium, with speakers from major companies invited to speak on topics felt to be of definite interest to members.

Scheduled speakers and their subjects were: Dr. A. M. Clifford, assistant director of research and head of the organic section, Goodyear Tire & Rubber Co., "Synthetic Rubber in Germany;" Dr. R. F. Dunbrook, head of synthetic rubber development, The Firestone Tire & Rubber Co., "Synthetic Rubber in America;" M. Scott Moulton, technical service manager, B. F. Goodrich Chemical Co., "Synthetic Rubber as a Plastic," including discussion of the uses of the company's *Geon* thermoplastics in combination with synthetic rubber.

Dr. Clifford was a member of the team of industrialists sent to Germany to study the plastics industry in that country after the war.

Newark SPI Chapter Holds Dinner-Dance

The Newark chapter of the Society of the Plastics Engineers meeting on March 13, heard an address by W. Paul Moeller, Celanese Corp. of America, Plastics Division, on the molding of ethyl cellulose. The film, "Careers for Cellulose," made by Hercules Powder Co., was shown.

The first annual dinner-dance of the chapter was held at the Hotel Essex on March 29 and was well-attended.

No speeches were made, but a fashion show in which some plastics materials were included was staged through the cooperation of the Kresge department store, Newark.

ENGINEERING
— News Letter —

By LEWIS WINNER
Market Research Engineer

Weatherproofed Coating

While the use of plastics as an effective coating has long been cknowledged, wartime demands accented this feature in a wide ariety of applications. Laboratories produced many unusual oating processes, particularly for aircraft work, where exceedngly rigid conditions prevailed. In a recent disclosure of one uch development it was learned that a plastics coating had been volved to strengthen and protect fabrics used in the fuselage, ings and tail. Tests had shown that even though tightly oven cloth resisted stresses and strains, it lost its value when eatherproofed with the usual cellulose-coating compositions. hese coatings often separated from the fabric, forming blisters hich cracked and caused the coating to peel off. The cloth en not only lost its weatherproofing value but its stress and train resistivity.

Solving a Problem

To overcome this problem, Camille Dreyfus, of New York, eveloped a plastics-weatherproofed coating, using cellulose aceate or other organic ester of cellulose of a relatively low degree sterification. With this weatherproofing film the base fabric ssumes increased strength and tenacity, and, in addition, is deoid of blisters and peeling.

A cellulose acetate having an acetyl value of 40% to 45% was ound to be most suitable for the base coating. In preparing his low acetyl cellulose acetate, cellulose is esterified with acetic

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VETERANS: ASK ABOUT G.I. TRAINING

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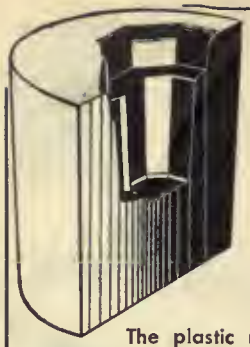

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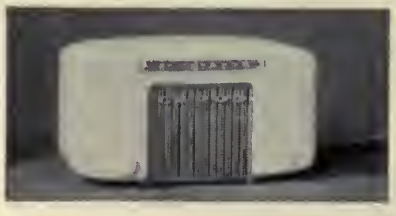

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anhydride or other organic acid anhydride in the presence of catalyst such as sulfuric acid and a diluent such as acetic acid.

A number of volatile solvents may be used to dissolve the cellulose acetate base. These include ethyl alcohol, acetone, ethyl acetate, etc.

To provide the coating with flexibility, plasticizers like dimethly phthalate or triethylene glycol may be used.

A typical plastics base-coating composition includes: cellulose acetate (42.9% acetyl, calculated as acetic acid), 75; acetone 395; methyl ethyl ketone, 67; ethyl alcohol, 92; benzol, 102.5; benzyl alcohol, 17.5; and triphenyl phosphate, 15 *(all parts by weight)*.

This base coating is applied after the fabric has been attached to the aircraft structure. A base film forms and there is some shrinkage of the fabrics. In the next step, a top-coating composition is applied. This consists of: Cellulose acetate (54.5% acetyl), 150; glyceryl phthalate, 100; ethylene dichloride, 750; ethyl alcohol, 163; methyl glycol, 96; and methyl glycol acetate 100 *(all parts by weight)*.

One or more coats of the top-coating composition are applied depending upon the fabric used and the area to be covered.

Polystyrene Applications

Some unusual applications were likewise found for polystyrene another wartime-accelerated plastics development. In the communications industries, for instance, polystyrene was adopted for use in capacitors.

The development began during the design of the gun director *M-9*. It was necessary to secure a very compact capacitor with extremely low dielectric absorption—much lower than that of mica or any other of the available dielectrics. The gun director required a capacitor that would completely discharge on only a momentary short circuit. Polystyrene alone seemed to provide this property.

The capacitors, developed by Bell Telephone Labs., were found to be far superior to mica capacitors, particularly at the lower frequencies. As a result, they were also employed in filter and network systems, with great success.

Superior Resistance Qualities

During studies of the insulation resistance of polystyrene capacitors it was found that such resistance at room temperature was much better than that of paper and mica types. For example, polystyrene had an insulation resistance of 350,000 megohms at 100° F; mica's resistance was only 7000 megohms at the temperature, and paper had a resistance of 4000 megohms.

The relative residual charge of polystyrene, mica and paper capacitors was also studied at Bell Labs. At 40° F polystyrene had a charge of 1; silver mica, 10; mineral wax paper, 8; and mineral oil paper, 15. At higher temperatures the difference was even more noticeable. At 150° F the charge of polystyrene was 2, while that of silver mica was 23, and of mineral wax paper, 40.

In aging tests polystyrene also proved superior to paper and mica. While the two latter-named materials varied substantially in temperature cycles ranging from —40 to +150° F, polystyrene showed little variation.

In only one respect was the polystyrene capacitor found inferior to mica. This was in the temperature coefficient of capacitance. However, it was found that this could be offset by employing resistances with a temperature coefficient of opposite sign in the circuit.

Control of Odor

Control and elimination of odors developed during the aging of plastics has been given much study. Although some plastics like the vinyl resins, are inherently odorless, odors do develop during aging. The extent of the odor is predicated on the heating and processing of the resin during its formation.

To eliminate this deficiency, water or other solvents have been tried. However, these processes seemed merely to minimize the odor. Complete elimination of odors has now been made possible by an odor-stabilization process, developed by the late Victor Yngve, and now being used by Bakelite Corp.

The use of small amounts of a relatively non-volatile organic acid anhydride serves as a basis of a solution of the problem. This anhydride consists of a mono or polycarboxylic acid and an aromatic. Saturated or unsaturated aliphatic acid anhydrides were also found suitable. The organic acid anhydrides which proved effective included maleic, citraconic, lauric, stearic, etc.

The percentage of the odor-stabilizer used can vary from .25% about 5% of the weight of the plasticized composition.

In preparing an odor-stabilizer material for study a vinyl resin mposition, prepared by a conjoint polymcrization of vinyl nloridc with vinyl acetate (containing about 94% of vinyl nloridc) and dioctyl phthalate, was used. This composition ntaincd 64% by weight of the vinyl resin and 32% by weight f the plasticizer, thc balance bcing carnauba wax lubricant, eat stabilizing and color materials. No odor was evident when ic material was originally prepared.

In the odor tests, a portion of the composition was worked on differential roll mill at about 135° C for 8 min, at the end of hich period a noticcable odor was evident. Then another por-on, treated, was tested. In the treatmcnt, .5% by weight of hthalic anhydride was added, and the composition was milled 135° C. After more than 16 min of this heat treatment no lor was apparent.

Whilc no detailed explanation for thc success of this pro-edure is available, it appears that the odor-stabilizers combine ith quantities of water prescnt in the plasticized compositions, nd thus prevent hydrolysis of the ester plasticizers.

ligh Polymer Developments

The new science of high polymers involving analysis of molec-lar properties, has attracted considerable attention. The Bu-eau of Standards in Washington has decidcd to keep pace with evelopments in this new field by forming a special educational rogram, which involves a Colloquium on High Polymers. Inder the sponsorship of Dr. Robert Simha, who has just joincd ne organic and fibrous materials division of the Bureau of tandards, meetings will be held one evening each week. Topics iscussed will include: "Properties of Solutions of High Poly-ners;" "Physical Properties of Rubbers, Plastics and Fibers;" nd "Mechanism of Formation and Degradation of Long Chain ompounds."

While the sessions will be primarily for membcrs of the Bu-eau, visitors will be permitted to attend occasional sessions, ac-ording to present plans. END

the plastics LIBRARY

PLASTICS MOLD ENGINEERING

by J. H. DuBois and W. I. Pribble

In "Plastics Mold Engineering," the authors havc compiled an accurate and rather complete handbook of basic principles, best-established practices, and associated information relating dirccly to the tool and product design of the molding phasc of the plastics industry. Through their own expcrience and acknowledged contributions from experienced engineers and designers associated with the molding of plastics parts, the basic factors involved are removed from thc trade secrct category for the benefit of all.

Six of thc twelve chapters contain most important informa-tion. These deal with Plastic Product Design, Designing and Drafting Practice, Compression Molds, Transfer Molds, In-jection Molds, Cold Mold and Extrusion Die Dcsign. The other six chapters deal with plastics molding as a gencral sub-ject that includes the various molding systems; materials and tools, tool making cquipment and methods, mold materials, special fixtures associated with molding, and mold sampling and maintenance.

The appcndix contains many tables of gcneral information which are constantly used in mold dcsign work. Careful edit-ing has eliminated any major errors or unproved theories.

Exceptions may be taken to some statements made in the

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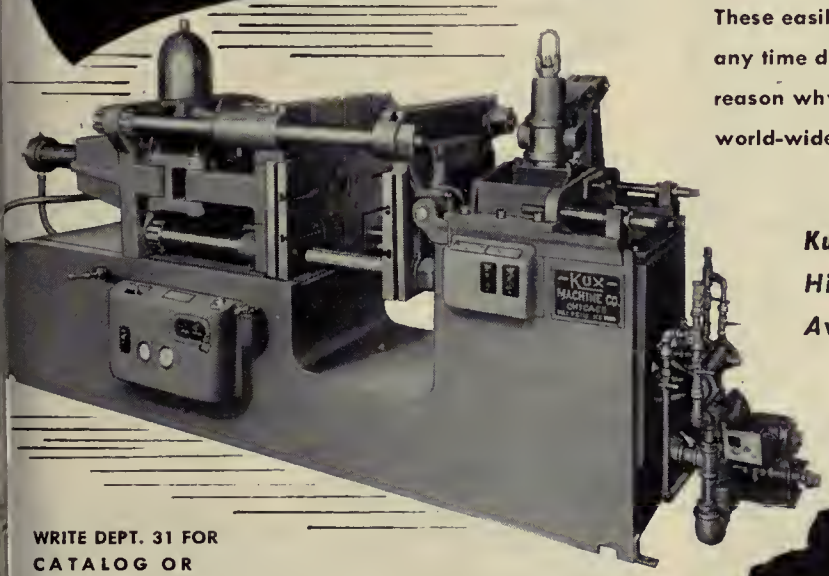

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book. For example, a specification "Clearance Between Cavi and Punch Must Not Exceed .002"," is made on the illustrati of a mold design for a single cavity automatic mold in the cha ter "Compression Molds." Certainly one group of enginee and tool designers who have had wide experience with th type of mold will take issue with this specification becau they have found that when this clearance is between .006" a .008" better mold operation and a higher percentage of go parts will result. Such exceptions are indeed of minor ir portance and do not detract from the book's overall value.

Many senior engineers and mold designers have the respo sibility of training new personnel for their organizations. T them, "Plastics Mold Engineering" will be a real time-save To illustrate, much time must be devoted to the subject tolerances and their use. In the chapter "Designing and Draf ing Practice," this subject is covered in detail and will ser as a text book. Again, the proper sequence of elements a calculations that go into the development of a mold design a time-consuming subjects. In the chapter "Compression Molds a concrete example of this task is given, so that by referring h trainee to this basic example, the experienced technician w have additional hours to spend on the consideration of the mo involved problems.—*American Technical Society, Chicago, I 494 pages, $7.00.* REVIEWED BY E. F. KEUSCH.

SPI 1946 DIRECTORY

By Society of the Plastics Industry

Third Annual Directory of members of the Society of t Plastics Industry, listing more than 520 company members a more than 650 individual members.

Activities of the Society are described; its by-laws and i technical committee regulations for both the United States a Canada are set forth. There is a comprehensive breakdown company members into classification of molders, extruders, lam inators and fabricators, material manufacturers, machinery ma ufacturers, publishers, and others; the "Who's Who in Plasti in the United States," and "Who's Who in Plastics in Canad sections list key personnel.

A material index and a product index for the U. S. and f Canada, as well as a machinery index for each, is included. The is also an index of company members.

Detailed SPI Organization and Engineering and Technic Committee charts are also contained in the book, which attractively bound in a polyvinyl butyral coated bookbindin material.—*John B. Watkins Co., New York, N. Y., 275 page*

Plastics in Toyland

(*Continued from page* 46)

sary in order to make the boat hull and "iron" body inte changeable.

Everything for the Kitchen

Young doll-house enthusiasts can now add a gleamin variety of plastics furniture to their miniature collection In such furniture, startling realism is often achieved in bot visual texture and detailed form through molded thermo plastics. Kitchen sets produced by the Plastic Art Toy Cor poration of America, reproduce authentic equipment in scal models of injection molded white polystyrene. All the es sentials of a modern kitchen—refrigerator, sink, range, cabi nets, table and chairs—are included. So detailed are thes models that some architects are said to be considering thei use in scale homes.

These sets are available with or without the addition o blue polystyrene bases. With the base an all-inclusive eleve piece set is designed to retail at $2.75. A five piece set con sisting of table and four chairs is offered at $3.66 per doze wholesale. This concern also has a dining room set on th way to production.

The Renwal Manufacturing Company manufactures a similar kitchen group, as well as other sets for every roo in the house. The company features authentic period furni ture for living and dining rooms, producing mahogany tone in the injection molded materials. A multitude of intricat

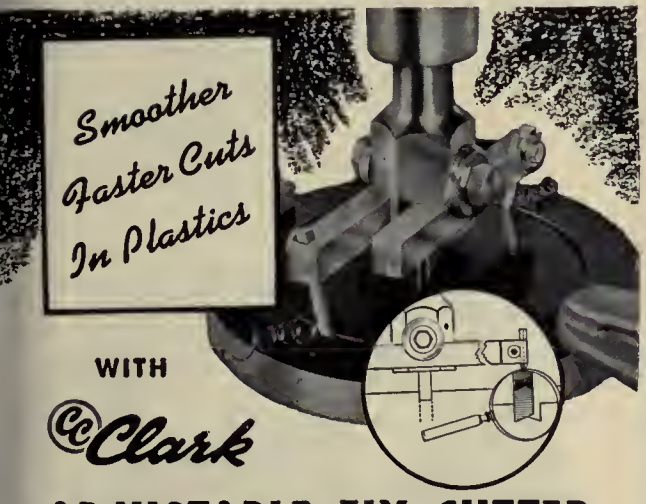
nolds are required to produce these sets, which retail at bout 85¢ to $2 each.

Furniture sets of clear acrylic, shown by Paula Products, re produced by combining bits of flat acrylic sheet with piral pieces, into chairs, tables, lamps, etc. These retail at 2 a set.

For the boy entering the hobby-craft stage, as well as for dult enthusiasts, Gordon Varney, Chicago, produces scale eproductions of airplanes and boats, with intricately de-ailed parts to be assembled by the hobbyist. One such model s a PT-17 trainer with fuselage and wings of yellow *Tenite* , and motor, propeller, and wheels of black *Tenite II*. As-embled with acetone, it lends itself to various striking ef-ects as a desk piece. Among the ship models, Varney roduces a submarine entirely in *Tenite*, with both the large ull and the many finely designed minute parts to be assem-led by the hobbyist being injection molded. An LST with wooden hull has 96 such intricate parts also injection nolded of *Tenite*.

Accurate modeling is enhanced for older boys in a model hat really runs. The Harvey Machine Co., Inc., Los An-eles, produces a scale model 1′/1″ of the 21′ Chris Craft peed boat, that runs 800 feet on a wound coil-spring motor. The hull, 18″ long, is injection molded in one piece of poly-tyrene. Every detail of the original is authentically repro-luced in molded red, white, and blue polystyrene. Motive ower is transmitted from the coil-spring to a brass pro-eller through a shaft by a series of reduction gears that nable it to run out in strong, slow revolutions for 5½ mins. Steps etched into clear polystyrene, steering wheel, radio nd cockpit fittings, and luminescent acrylic headlights, are ome details that impart authenticity to the model which is o retail at $14.95.

Enterprising lads between the ages of 10 and 16 can now



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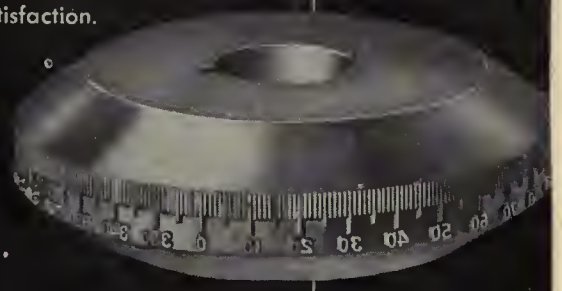

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manufacture their own colorful *Tenite* toys—cowboys, Indians, animals, train cars, club pins, buttons, buildings—as well as golf tees for adult members of the family. A this is made possible by the Plasticor, an educational to machine designed by the N.R.K. Mfg. & Engineering C for the injection molding of *Tenite* cellulose acetate. model of the Plasticor was first demonstrated last mont at the National Plastics Exposition, at the booth of Tenne see Eastman Corporation, manufacturers of *Tenite* cellulo acetate.

The Plasticor is constructed on the principle of a re injection-molding machine. It measures 12″ in heigh weighs approximately 17 lb, and is sturdily built. It i made of steel and alloy parts and has a heavy aluminu frame. A rubber pad on the base prevents the machin from scratching furniture, and it may be set up on th dining-room table with impunity. Furthermore, since bot the machine and the *Tenite* used in it are absolutely clear the molding process should create no dirt or mess. Th machine may be plugged into any 110-v electrical outle in the house, either AC or DC.

The toy injection machine is of the vertical type, wit a ⅝″ plunger-type ram which has a stroke of 2½″. This i operated by hand. When pressure of 50 lb is exerted on th 10″ operating lever, a pressure of 6000 psi is effected—considered remarkable for a machine of this size, in viev of the fact that large machines exert 14,000 to 20,000 ps to mold *Tenite*. According to the manufacturer, the pres sure of the Plasticor presents no hazard, for when th mold is clamped into position on the bottom of the machine there is not enough space between mold and nozzle for fin gers to be caught. Manual operation assures additiona safety.

Within 5 to 10 min after connecting the toy machine,

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TO SHARPEN - NICK WITH STRING - PULL THE PAPER

German Plastics

(*Continued from page* 56)

truders—said to have been originally designed by an Italia company. The units were horizontal, having two drive screws operating side by side with some intermeshing c flights. Screw diameter was nearly 2″, pitch was low, dept large. The extruder was fed a mixture of base resin plas ticizers and modifying agents and extruded a uniform usabl product at good rates. They were said to be suitable fo filling a series of molds mounted on a rotating table, as wel as for extrusion.

Screw extruders had been used for several years by Nord deutsche SeeKabelwerke for the production of *Styroflex* (polystyrene film). The equipment and processes had un dergone many developmental changes but were operated o a production scale of 20 tons per month. Film thickness ranged from .01 mm to .15 mm (.0004″ to .006″). Toler ance of 15% (maximum) was permitted. Experimenta sheet of .008 mm (.0003″) had been made.

To form the sheet, polystyrene was extruded as a tube stretched at controlled temperatures in two directions, an then slit. A battery of seven machines, each housed in a glass enclosure, and all located in a hood ventilated room made the sheet. The plastics used for this purpose was *Trolitul III* (mass polymerized styrene), ground to 12-30 mesh The powder was not specially dried. It was placed in the extruder hopper and fed to the extruder by a small screw which metered the powder to the extruder screw below. It appeared that the feed screw metered the polystyrene to the extruder at a slow rate to keep the extruder screw weaned *Trolitul III* was processed without additional lubricant, antioxidant, or other addition. It had relatively sharp molecular weight distribution.

The machine was a screw extruder, with a screw diameter about 175 mm (7″), uniform pitch, constant 5 rpm speed, driven by a 3.7 KVA motor. It delivered to a die head carrying filter plate and fine screen. For sheet .020 mm (.0008″) thick, the conditions were barrel 144°C (292°F), head temperature 197°C (387°F), and no heating or cooling on screw. The tube die produced a cylinder 6 cm (2.35″) in diameter with a 1–2 mm (.040–.080″) wall. Production was 2–5 kg per hr (4.5–11 lb) and it is estimated that 26–30 kg (58–67 lb) of hot stock was in the machine at one time. Thus the polystyrene was milled (in the absence of air) for 5–10 hr and, although some degradation of the polymer was expected, it was claimed that little took place.

The extruded tube was immediately stretched in a horizontal plane over a series of small rollers outlining a parabola. This stretched laterally while at the same time the stock was stretched longitudinally by the take-off mechanism. At each side of the stretcher parabola were located two small air jets (2-inch water pressure) for edge cooling, stiffening, and minor thickness control. Sheet thickness was mainly controlled by the take-off speed. Leaving the wide end of the parabola, the tube was slit by fine blades, the two sheets passing to the windup rolls. The net stretch measured by heat shrinkage was about 3:1 in both directions. The parabolic stretcher was about 15″ long and at least 12″ wide, with 15 small wheels along each side.

Most of this film was slit into tapes of varying width and helically wound on wire for coaxial cable insulation by a process equally ingenious to that used for film extrusion.

While the extrusion portion of the German plastics fabrication industry was not the largest, it appeared to be one of the most diversified and rapid-growing. Much the same can be said of American extrusion development, a few years having brought many changes. (TO BE CONTINUED)

Hobbing Ideas

(Continued from page 76)

the hobbed-out cavity by conventional machining operations. He pointed out that the hob is an individual problem, and recommended a minimum draft of .010″ per inch. In the molding shop of his company it was found best to eliminate the base.

In discussions of the life of hobbed cavity versus machined cavities, differences of opinion were expressed. Mr. Huling felt that hobbing brought about changes in the structure of the steel which made it more difficult to heat treat. Mr. Marx pointed out that for hemispherical shapes, work hardening may give a longer wearing cavity, though it was generally felt that machined cavities would outlast hobbed cavities. Mr. Huling further brought out that the land area of multiple cavity dies may receive an abnormal pressure because of excessive flash at one location, and that a soft core will not stand up. Further, a polished surface will not heat treat as well as a rough surface. Mr. Windman brought out the fact that his company has done considerable hobbing of alloy steels with success, which permit hardening entirely through the core of hobbed cavities.

The problem of removing hobs from hobbed cavities was discussed, and Mr. Kerseg recommended a gear puller for the job. He also described a technique of hot hobbing for very difficult jobs where flow cannot occur at room temperature. Mr. Windman pointed out that more hobs were probably broken in removing them from the cavities than in any other way. He also warned against threaded holes in the master hob, which showed cracks every time after heat treatment. Small diameter drilled holes were recommended for air relief. END

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Injection Mold Design, Part I

(*Continued from page* 74)

mold. On short runs, where the parts involved do not vary too much in shape, thickness, etc., this practice is justifiable, but, generally speaking, combination molds are extremely bad practice. Every molded piece is a problem to be solved by proper cavity design, ejection, cure, temperature, gating, etc., to suit that particular piece. To group two different pieces in the same mold and thereby necessitate the overcoming of two sets of problems with restrictions as to cure, heat, gating, etc., thus placed upon the job is to invite trouble.

Furthermore, rejects never run the same on the items in a combination mold, and an over-run of one part will always be required. This must be taken into consideration in figuring the cost of running this type of mold.

The designer must realize that in designing a combination mold he is taking upon himself responsibility for departing from good practice, and should not do so unless the parts thus brought together are so similar that they can be molded under the same conditions. (TO BE CONTINUED)

ED. NOTE: The photograph on the first page of the article was taken at the Cruver Manufacturing Co. plant. The machine shown is an 8-oz. HPM injection press, and is operated by World War II veteran R. Bordon.

Precision Lenses

(*Continued from page* 30)

combinations of these factors. Moreover, it retains its transparency through lengthy periods of aging and weathering, showing excellent permanence of optical qualities.

As low scratch-resistance is the chief shortcoming of plastics for use in spectacle lenses, it is of special interest to note how the scientists tackled this thorny problem in their project.

One method tried was that of surface-hardening the plastics surface with other compounds. "Reasonable success" was reported. Another method was the synthesizing of cross-linked polymers which are much harder than CHM and polystyrene (like ethylene dimethacrylate and allyl methacrylate).

While the project ended before a definite solution to this problem was found, sufficient progress was made to justify the expectation that one or more cross-linked polymers will ultimately replace the present easily-scratched polymers. The former have, for the most part, low coefficients of expansion, high softening points, and satisfactory resistance to abrasion. A few lenses were made with ethylene dimethacrylate and allyl methacrylate, but the manufacturing difficulties involved were not overcome.

Still another method of overcoming low scratch resistance was the hardening of plastics surfaces by depositing on them a thin, hard, transparent coating of magnesium fluoride or silicon tetrachloride. Some two dozen compounds were tested for the hardening of polystyrene. Several were found to be "fairly satisfactory," among them phenacite and glossularite.

On the other hand, "considerable success" was reported by research scientists from the California Institute of Technology, working on a similar project of hardening methyl methacrylate. A film was deposited by exposing the plastics alternately to water vapor and to a mixture of silicon tetrachloride and ozone. By this means, the plastics surface can be hardened so that it is 20 to 30 times more resistant to normal wear. This method shows promise for other plastics as well, including CHM and polystyrene.

The precise method of treating the plastics is as follows: After the surface has been thoroughly cleaned, it is conditioned to a humidity of between 50 and 85%, for from 30 to 65 hours. The plastics is then placed in a treatment vessel which is evacuated to a pressure of 25 to 35 mm. Silicon tetrachloride is permitted to evaporate into the evacuated vessel, and a mixture of oxygen and ozone (2 to 5% ozone) is added to equal the atmospheric pressure. After exposure to these vapors for about two hours, the plastics is humidified for two hours and again exposed to silicon tetrachloride and ozone for from one-half to two hours. A final humidification for one or more hours concludes the treatment.

Another hardening process investigated was the application of silicon tetrachloride and nitrogen dioxide. This showed considerable promise, but the ozone treatment was reported to have wider applications.

Of interest to manufacturers of plastics spectacle lenses, also, is the new tests for hardness of plastics developed by the research project. These are the abrasion, the wear, the scratch, and the temperature tests. They make possible finer quantitative analyses of the hardness of plastics.

In the abrasion test, a pad of rubber impregnated with a selected abrasive is rubbed back and forth over the plastics surface. A machine called an abrader was developed to insure definite pressure and eccentric rotation of the pad. The extent of abrasion is measured by the difference in the amount of light reflected by an unmarred and by an abraded sample. For this purpose, a reflectometer is used. A small beam of light is concentrated on the unabraded region and the electric potential generated by the reflected beam, striking a photocell, is balanced by a potentiometer system. Less light strikes the photocell from the abraded surface because of increased scattering losses, and the unbalancing of the circuit is measured by the galvanometer reading. An empirical scale of hardness was developed, based on the shift in the galvanometer reading, as the abraded and unabraded regions of the plastics are measured.

What were the findings according to this scale for various plastics? The test showed that methyl methacrylate, when treated by silicon tetrachloride and ozone, can be made 15 times harder than it normally is. The treatment involves one hazard, however, and that is the possibility of crazing. The temperature test showed that crazing increases in proportion to the degree of hardness of the surface film. For example, little or no crazing takes place on samples hardened to 12 AN (AN being the unit abrasion index) or lower, but samples hardened to 20 AN developed extensive craze lines. CHM has a normal abrasion resistance of 0.7 AN. Hardening may increase this to from 10 to 14 AN, but the film becomes rather cloudy at this point. The softness of polystyrene was overcome by coating, which increased its hardness from 0.1 AN to from 1 to 3 AN.

In order to compare the abrasion number with the resistance of a surface to actual wear, a wear test was devised, involving the rubbing of the plastics by hand with cloths and exposing it to weathering. For a more rapid and convenient test, however, the scratch test was found to be preferable as a laboratory control method. By means of an instrument called a gramoscope, a scratch is applied to the plastics surface and the minimum weight is determined which will cause a diamond stylus to produce the first apparent scratch as observed through a microscope.

It is interesting, at this point, to compare these findings with the experimental findings obtained by the research department of Rohm and Haas Co., which has done "very extensive work" in attempts to improve the scratch-resistance of methyl methacrylate. It has tried various hard coatings, but the investigators have found that if the applied films are too thin, they break on impact, are not sufficient protection against a very severe scratch, and

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crack off when the plastics sheet is flexed. For this reason the film would have to be applied after the plastics sheet has been formed, and this is a disadvantage.

They have explored also the possibility of changing the chemical formulation of the sheet but found that for relatively small improvements in scratch resistance, some other desirable characteristics would have to be sacrificed, such as impact strength, tensile strength, ease of forming, etc.

An important item of the Polaroid project was the development of practical methods for molding optical plastics. These had previously been molded under high temperatures and pressures. The result was generally poor surface quality and considerable internal strain. It was found that the best results were achieved by polymerization in a mold at moderate temperature and without pressure. Important also is the fact that the compound is partially polymerized before its introduction into the mold. Suitable polymerization catalysts have to be applied. Shrinkage was partially compensated for by raising the temperature during the process, causing differential expansion between the mold and the plastics.

The mold itself is usually made of pyrex and the finished plastics elements are said to retain to a high degree the surface characteristics and perfection of the mold.

The molding of the lens is performed as follows:

The free-flowing monomer is synthesized and purified. It is heated to start polymerization but cooled at the certain point where it is desired to halt the process. The viscous plastics, mixed with catalyst and mold lubricant at room temperature, is poured into molds, which are then oven-baked at relatively low temperatures (40° to 70°C) for from five to 85 hours.

During the baking, the plastics polymerizes completely and becomes a solid. Separation of the plastics from the mold is accomplished by soaking in water. A stability bake of five days at 60°C prevents crazing of the surface. No grinding or polishing is necessary after removal from the mold. The same molds can be used again and again.

The process of molding plastics spectacle lenses is substantially the same. While exact details of the methods used by optical companies now experimenting with the product are not available, an American engineer who developed plastics spectacle lenses before the war described the molding process he used as follows:

Clear acrylic resin was poured into a multiple cavity mold consisting of 32 cavities, each conforming to the curves of various powers or prescriptions. Sixteen were for convex and the rest for concave lenses, the powers for each type of lens ranging from 1 dioptre to 16 dioptres (the "dioptre" being the unit of measurement of the power of a lens).

The plastics lens that emerges may be completely formed as to size and shape, in which case its edges can be bevelled on the sandstone used for glass lens-grinding for insertion into a frame. On the other hand, it might be more advantageous if the plastics lens emerged extra large ("uncut") so that it could be cut and edged to any shape or size required.

The engineer stated that the cost of each mold, consisting of a top and bottom cavity for the two surfaces of the lens, was about $200. For a 32 multiple cavity mold, therefore, the cost would be approximately $6,400, the dies being made of stainless steel. This estimate is based on simple spherical lenses. For lenses having more complicated curves (cylinders or sphero-cylinders), each double-cavity mold would cost $300 instead ($150 for each surface of the lens).

These molds are made in one of two ways. One method is to select stainless steel that has no pores, pits, or hollows and cut the surface in negative duplication of the curve desired. Regular optical methods are followed: the mold is rough-shaped on a lathe and ground in a machine-grinder.

All grinding marks and obvious defects are removed by hand grinding, using a cast iron lap with diamond powder or coarse emery as an abrasive. Successively finer grades of emery or diamond are used on the lap until a smooth semi-glossy surface is achieved. Final trueing and polishing of the surface is accomplished by the use of a pitch lap using rouge as a polishing medium.

A faster and less expensive method of making the mold is by using a finished glass lens as the master, and electroforming the mold. The lens is inserted in a metal holder and fixed by wax or pitch on the edges. The glass surface is silvered, and copper is then deposited electrolytically on the silver. A nickel-plating solution is laid on the copper, forming a hard coating ⅛ inch thick. The metal mass is then applied to a trueing lathe and faced off. The insert with the glass lens is removed, and what remains is a mold that duplicates in reverse the curvature of one side of the lens. The engineer added that plastics bifocal lenses can also be made by grinding an inset in a die for the reading segment.

The superiority of plastics over glass lenses becomes apparent when the limitations and shortcomings of the latter are examined. Hymns of praise are often sung to glass, but, efficient as it is in correcting and aiding human vision, it is unsatisfactory as material for spectacle lenses. Consider, for one thing, the costly and elaborate process involved in manufacturing a finished spectacle lens. The process may be tabulated as follows, starting with the creation of glass in molten form:

(1) It is poured on a casting table where a giant roller flattens the glass into sheets. (2) These are shoved into annealing furnaces, cut into squares, and inspected for defective parts, which are discarded. (3) They are heated and pressed into shape in the molding room. (4) They are annealed again, this time for several hours. (5) Inspection for defects is an important next step. (5) "Surfacing": the rough "blanks" are attached to grinding blocks and pressed against revolving "laps" having the desired curve. At first, coarse emery is used. Then several finer grades are used successively. (6) After one side has been thoroughly ground and polished, the half-finished lens is removed from the block and the other side subjected to the same process. (7) The "uncut" lens is then marked and cut according to size and shape specifications. (8) It is ground (edged) and bevelled, and holes are drilled for rimless mountings.

The above refers only to "single" lenses of the usual type. Much more complicated is the manufacture of bifocal lenses having double powers. There are various types. In the popular "fused" kind, the reading segment consists of flint glass which is fused in an electric furnace into the upper crown glass, flint having a lower melting point than crown. In other types, reading segment is ground into lens.

This complicated and costly process of manufacture results in a lens that is woefully fragile and delicate, judged by the standards of other commodities in daily use. Lens breakage is so common that lens duplications constitute an appreciable part of any optician's business. Glasses may break even in heavy shell or metal frames. As to the popular rimless type, they chip easily at the edges and crack at the screw-holes, often at the slightest strain. Lens breakage occurs even at the hands of expert opticians while grinding and adjusting glasses.

As to the objection that plastics lenses scratch easily, it must be borne in mind that this defect is characteristic of glass also, although to a lesser degree. Opticians warn patients against resting their glasses on a table or hard surface with the outside surfaces in contact, for this reason. Even when precautions are taken, lenses worn for a year or so frequently show hair-line scratches. Certain types of

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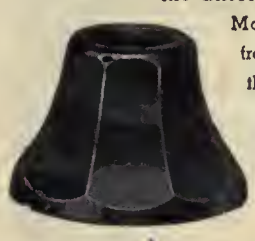

Ask us to help you see what plastics can do in your business. Just send photo, sample or specifications, and we'll tell you quickly if it can be made in moulded plastics.

THE MAGNETIC PLASTICS CO.

1900 EUCLID BLDG. • CLEVELAND 15, OHIO

INDEX OF ADVERTISERS • MAY, 1946

Advertiser	Agency	Page
Aaron Machinery Co.		112
Accurate Spring Mfg. Co.	Russell T. Gray, Inc.	51
American Flange & Manufacturing Co., Inc.	Freiwald & Coleman Advertising	7
American Molding Powder and Chemical Corp.	Lee-Murray Advertising Agency	97
American Phenolic Corporation	Evans Associates, Co.	21
Amos Molded Plastics	Sidenar and Van Riper, Inc.	26
Arrow Plastics Company	Powerad Company, The	115
Auburn Button Works, Inc.	Charles L. Rumrill & Company	70
Austin Tool & Mfg. Co.		110
Bamberger, A.	Laa-Murray Advertising Agency	90
Battalen, L. H.	Gunn-Mears Advertising Agency	112
Blaisdell Pancil Co.	Richard A. Foley Adv. Agency, Inc., The	108
Boice-Crane Company	Wendt Advertising Agency	100
Boonton Molding Company	A. J. Slomanson, Advertising	12
Brilhart, Arnold, Ltd.	Hanri La Motha Agancy	Back Cover
Cardinal Chemical Co.	Feldman, Lefler, Inc.	114
Catalin Corporation	Walter J. Gallagher, Adv.	Second Cover
Celanesa Plastics Corporation	Ivay & Ellington, Inc.	22
Cello-Plastic Chemical Co.	H. M. Dittman Advertising	109
Celluplastic Corporation	M. C. Diedrich	52
Celoid Mfg. Co., Inc.	Powerad Company, The	101
Chemaco Corporation	R. T. O'Connell Company	10
Chicago Moldad Products Corp.	Almon Brooks Wilder, Inc.	11
Clark, Robert H., Company	West-Marquis, Inc.	105
Columbian Rope Company	Barlow Advertising Agency, Inc.	71
Consolidatad Molded Products Corporation	Walter J. Gallagher, Advertising	77
Consolidated Products Co.	Diener & Dorskind, Inc.	108
Continental Can Company, Inc.	Batten, Barton, Durstine & Osborn, Inc.	23
Continental Plastics Corporation	Jim Duffy Company	72
Cumberland Engineering Co.	Richard Thorndike Precision Advertising	94
Curtis Pneumatic Machinary Div.	Oakleigh R. French & Associates	98
Defiance Machine Works, Inc.	Baeson-Faller-Relchert, Inc.	36
Despatch Oven Company	Harold C. Walker Advertising	100
Datroit Matarials Engineering Co.		110
Datroit Mold Engineering Co.	Charles M. Gray & Associates	107
Dow Chemical Company, The	MacManus, John & Adams, Inc.	17
Dry and Company		114
Duall Molding Corp.	Gunn-Mears Advertising Agancy	110
Durita Plastics Incorporatad	Lawrenca I. Evarling	6S
Eagel Signal Corporation	Bawdan Bros., Inc.	92
Ekstrom, Carlson & Co.	Cummings, Brand & McPherson, Adv.	112
Emeloid Co., Inc., The	United Advertising Agency	S9
Engineering Specialtias Corp.	Maxon, Inc.	11S
Famco Machina Co.	Western Advertising Agancy	113
Felsenthal, G., & Sons	Lieber Advartising Co.	84
Fanwal Incorporatad	Cory Snow, Inc.	47
Genaral Chemical Company	Atharton & Currier, Inc.	S7
Genaral Electric Co.	Benton & Bowles, Inc.	39
Gering Products Inc.	M. C. Diedrich	80
Girdler Corporation, The	Roche, Williams & Cleary, Inc.	13
Gits Molding Corporation	Marchandising Advertisers	106
Goodrich, B. F., Chamical Co.	Girswold-Eshleman Co., Tha	5
Gorski Bros.		81
Great Amarican Color Company		98
Grigoleit Company, The	Mace Advertising Agency, Inc.	9
Hydraulic Prass Mfg. Co., The	Jay H. Maish Company, The	
Interlake Chemical Corporation	Stanley Pflaum Associatas	7
Karlstad, Andrew, Co.		110
Kingsley Gold Stamping Mach. Co.	Continental Advartising Service	11
Kirk, F. J., Molding Co.	Cory Snow, Inc.	9
Koahler Equipment Company		114
Kreiger Color & Chemical Co.	Warren P. Fehlman Adv. Co.	10
Kuhn & Jacob Molding & Tool Co.,	Eldridge-Northrop, Inc.	7
Kurz-Kasch, Inc.	Kircher, Helton & Collett	2
Kux Machine Co.	Kuttner & Kuttner	10
La Rose, W. T., & Associates	Aldridge and Praston Advertising	8
Lanca Manufacturing Company		1
Lester-Phoenix, Inc.	Gragory Advartising, Inc.	1
Maas & Waldstein Company	Hutchins & Graves, Inc.	8
Mack Molding Company, Inc.	George Homer Martin	1
Magnetic Plastics Company, The	Gregory Advertising, Inc.	11
Martindall Molding Co.	Eldridge-Northrop, Inc.	8
Mayercord Co., The	C. C. Fogarty Company	4
Midland Die and Engraving Co.	Behal and Waldie and Briggs, Adv.	6
Molded Products Corporation	Cruttenden & Eger Advertising	3
Mosinee Papar Mills Company	Klau-Van Pietersom-Dunlap Associates	4
National Lock Company	L. W. Ramsey Advertising Agency, The	2
National Organ Supply Co.	P. W. Price, Advertising	11
National Plastic Products Co., The	Joseph A. Wilner Company, The	10
National Vulcanizad Fibre Co.	John Gilbert Craig Advartising	7
Nicholl Hard Chrome Service		9
Owens-Corning Fibarglas Corp.	Fuller & Smith & Ross, Inc.	1
Pearson Advertising Agency, Inc.		110
Pennsylvania Coal Products Co.	Lee-Murray Co., Advertising	15
Plaskon Division, Libbey-Owens-Ford Glass Company	Meldrum & Fawsmith Advertising	35
Plastics 5ervice Engineering		114
Plastics Industrias Technical Inst.	Beaumont and Hohman, Incorporated	101
Printloid, Inc.	Reiss Advertising	99
Radio Receptor Company, Inc.	John A. Finneran	6
Rayon Processing Co. of R.I., Inc.	Richard Thorndika Precision Adv.	76
Royle, John, & Sons		89
Schwartz Chemical Company	Gunn-Mears Advertising Agency	107
Siegel, M. B., Associates		110
Sillcocks-Miller Co., The	Fred H. Ebersold, Inc.	96
Sossner	Ehrlich & Nauwirth	105
Stokes, F. J., Machine Company	McLain Organization, Incorporated	116
Stricker Brunhuber Co.	Aldridge and Preston Advertising	111
Tannessea Eastman Corporation	Kenyon & Eckhardt, Inc.	31
Texon Industrial Corp.		114
Universal Hydraulic Machinery Co.	Gunn-Mears Advertising Agancy	112
Universal Plastics Corporation	Cayton, Inc.	9
Van Dorn Iron Works Co., The	Hubbell Advertising Agency, The	69
Velepec, Fred M., Co.	Schacter, Fain & Lent	106
Waterbury Companies, Inc.	Manternack, Inc.	102
Watertown Manufacturing Co.	R. T. O'Connell Company	87
Western Shade Cloth Company, Tha	Hardy Advertising	14
Worcester Mouldad Plastics Co.	C. Jerry Spaulding, Inc.	Third Cover
Wrigley, Wm., Jr., Company	Ruthrauff & Ryan, Inc.	82
Yardlay Plastics Co.	Byar & Bowman Advertising Agency	63
Ziv Steal & Wire Co.	Vernon S. Weiler Advertising	102

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fungi in the air might be partly responsible. At any rate, people often complain about this, showing that glass lenses do scratch easily. After a few years, any lens will generally show a cluster of scratches which may begin to interfere slightly with vision. This is especially true of workers engaged in trades where chemicals or flying particles prevail, and they may have to change their glasses often, as pits and scratches begin to invade their field of vision.

Another shortcoming inherent in the manufacture of glass lenses is the comparatively long time it takes to make the finished product. From "unsurfaced" blank to finished lens is a matter of hours even for simple lenses. And at every step in the scores of operations, there is the ever present hazard of chips, cracks, bubbles, grinding scratches, polishing scratches, greyness (from insufficient polishing), or stria (streaks in the glass like the trail of oil on water). Opticians or optometrists ordering lenses to be ground from wholesalers or jobbers habitually take into account the possibility of lens breakage, with resultant delay in delivery. The percentage of loss due to this hazard varies widely, depending on the quality of lenses used, as well as the efficiency of the workers, but even expert lens grinders cannot guarantee a day's output entirely free of chips or breakage.

Contrast this with the molding of plastics lenses, where manufacturing time is cut to the period of the cycle, a matter of minutes per lens instead of hours. Not only are lens hazards eliminated but waste of material also. Plastics will make the great piles of discarded and damaged lenses that accumulate in the optical glass industry every year a thing of the past, with consequent slashes in prices.

The chief problem confronting the manufacturer of plastics spectacle lenses, apart from the matter of scratch-resistance, is the great number of molds required to satisfy the various lens prescriptions of optometrists and ophthalmologists. In addition to spherical lenses, both convex and concave, ranging in power from 0.12 dioptre to 20 dioptres, there are also lenses with one or more sides having an irregular curvature. Each type of irregular curvature (cylinder or sphero-cylinder) can be either convex or concave and is ground for various powers, in gradations of 0.12 dioptre. Then there are combinations of spherical and non-spherical elements, so that literally thousands of different prescriptions are possible. Theoretically, this would require thousands of molds to produce plastics lenses to satisfy all possible prescriptions.

However, de Gooreynd, the pioneer previously mentioned, claimed that as most prescriptions fall into certain categories, it is possible to fill 60 to 70% of them with only 400 to 500 dies.

Even if this is admitted, however, the problem of the lens shape and size must also be considered in relation to the number of dies needed. This is no problem if the molded lenses are issued in "uncut" form, in which case they can be cut, edged and bevelled like the glass lens. For plastics lenses to emerge from the mold complete as to size and shape as well as prescription, would require thousands of molds even on the assumption that 500 dies are all that are necessary to fill most prescriptions. This is especially true because of the unusual variety of lens patterns that have blossomed out for both shell and rimless kinds, in the last ten years.

One method that might be feasible would be to make standard molds for the most frequently ordered powers in the more conventional patterns and in two or three sizes for each pattern. Lenses for other prescriptions or patterns would have to be molded in "uncut" form. Even in this case, the plastics lens retains its mechanical superiority, as cutting and edging involves no risk of chipping or breaking. On the other hand, the economic advantages of having the lenses produced in finished form might justify the huge initial capital investment required for the dies. END

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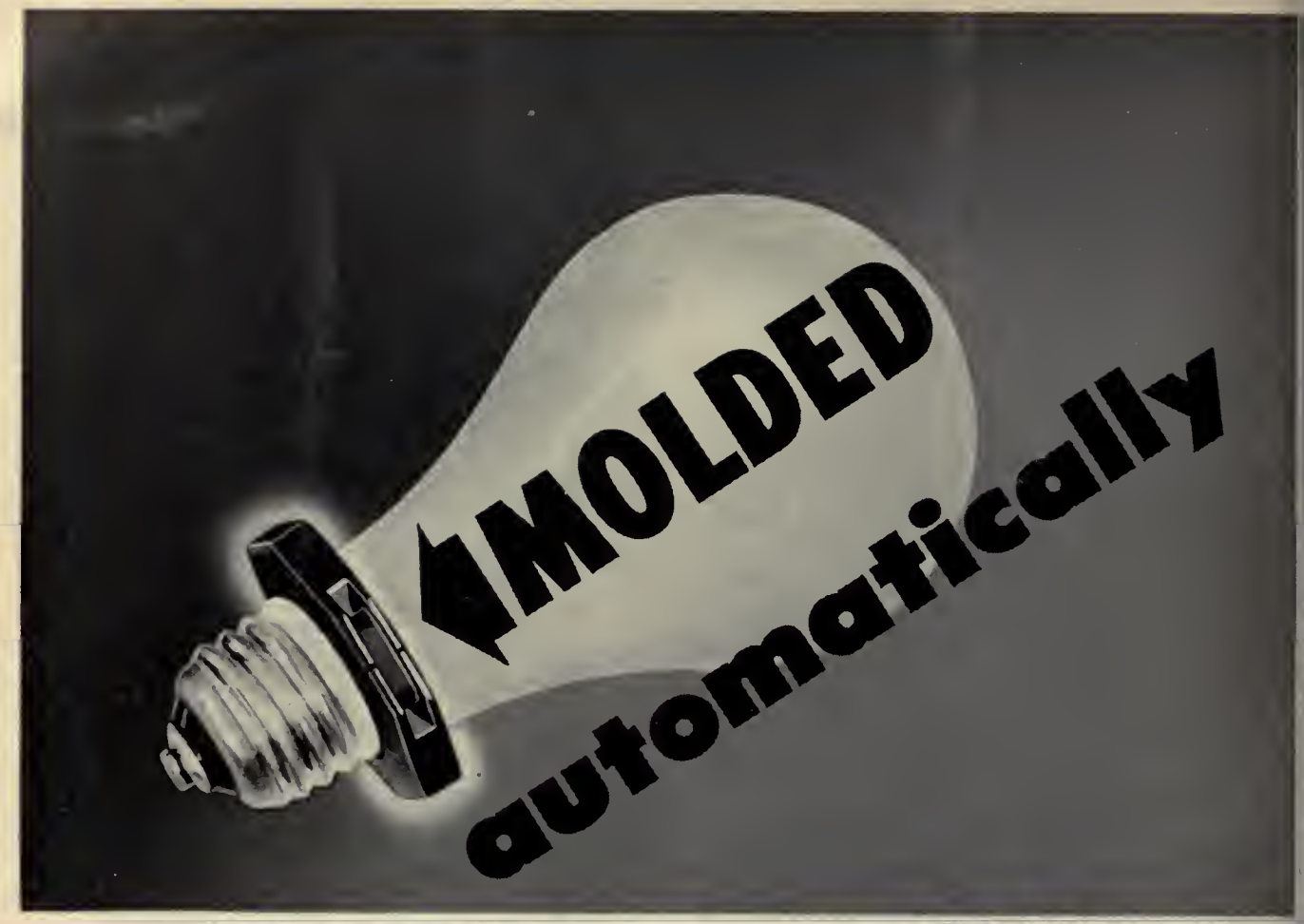

AT SUBSTANTIAL SAVINGS OVER CONVENTIONAL METHODS

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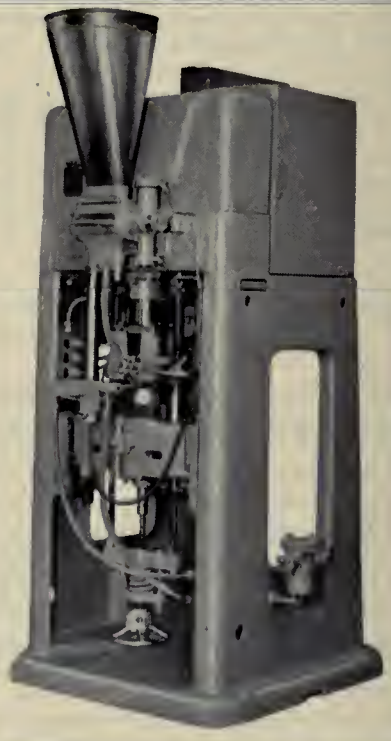

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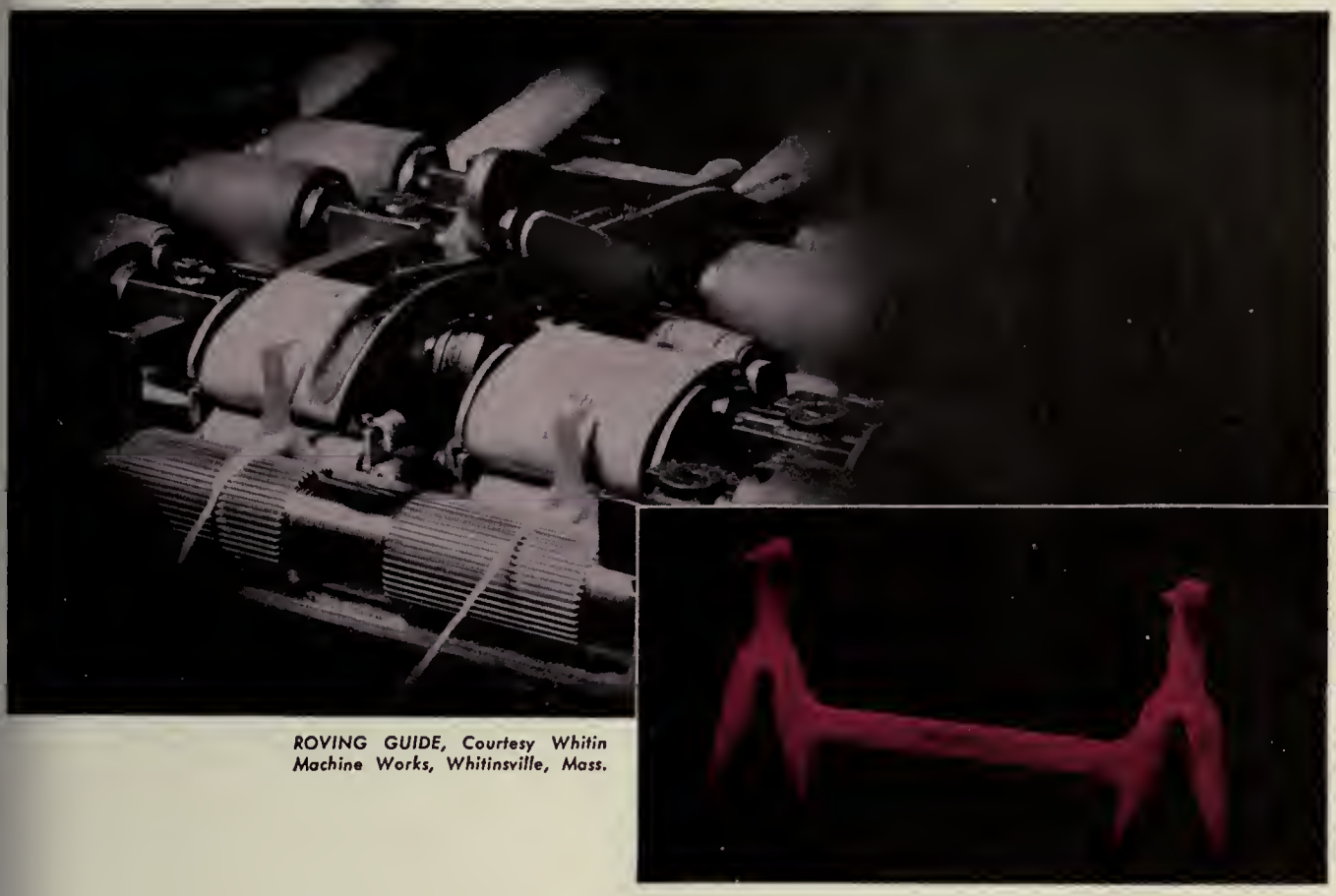

ROVING GUIDE, Courtesy Whitin Machine Works, Whitinsville, Mass.

GUIDE yourself accordingly

The Whitin patent Selvage Guide, custom injected by Worcester Moulded Plastics, quickly disposes of a major problem — the elimination of fly waste in the front drafting field of a Super-Draft Roving Frame. Not much heavier than a thimble, this guide is a striking example of the many new plastics applications we have helped to produce. It also embodies time and money-saving features, so typical of hundreds of products to which Custom Injection Moulding lends itself. Let our exceptional facilities, and our engineers, expert die designers, and die makers serve as your "guide" in the field of plastics.

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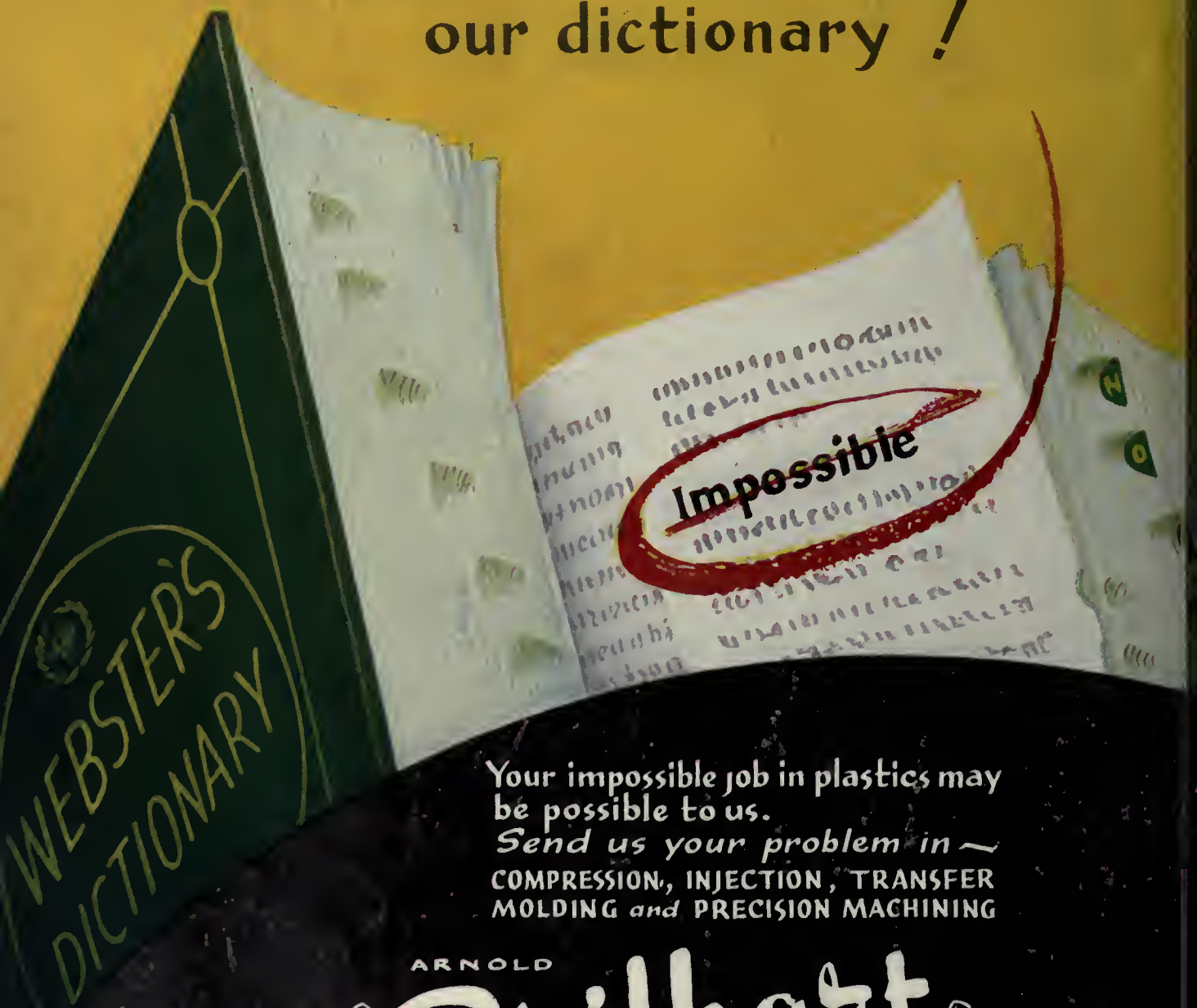

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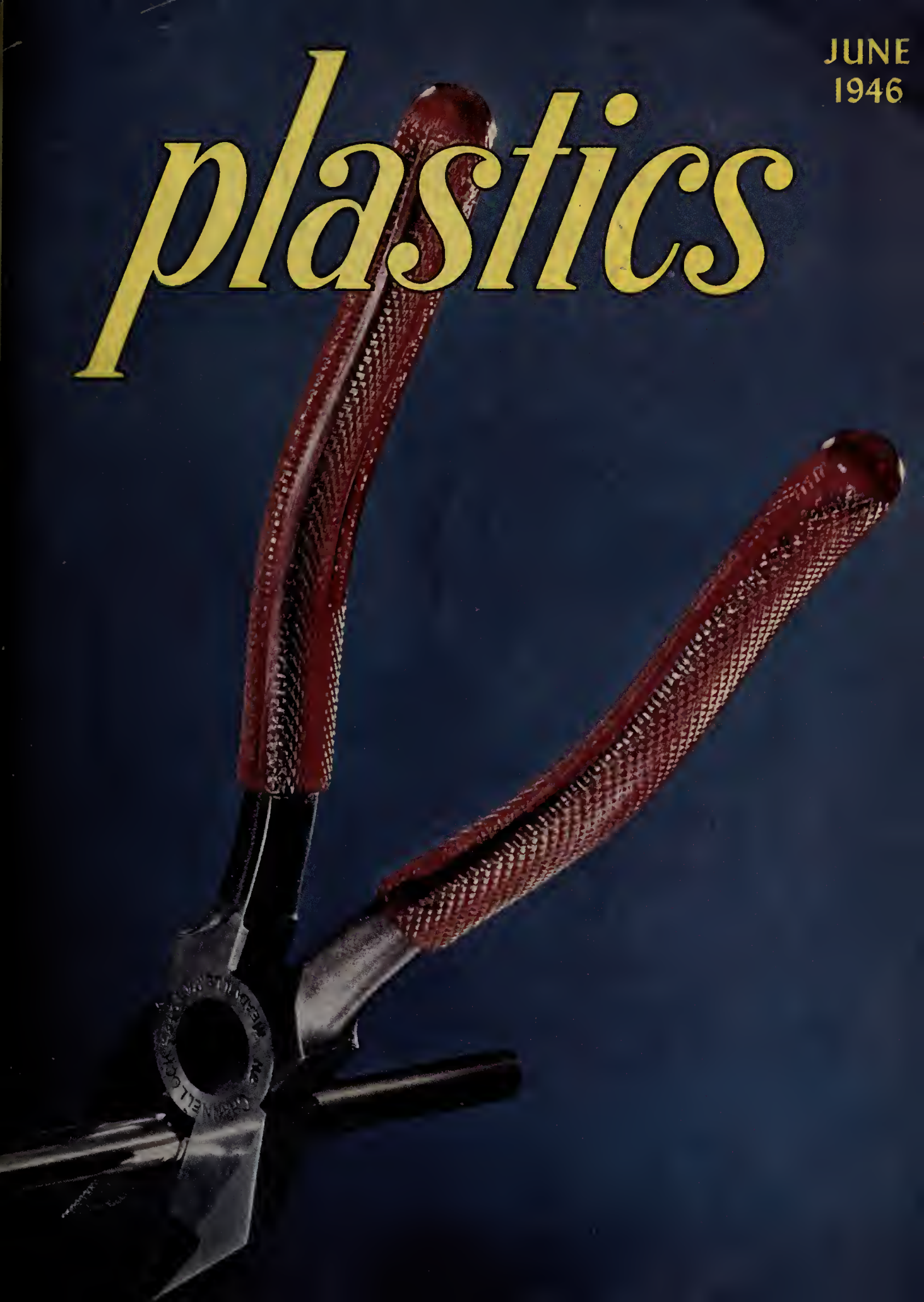

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Bulletin 4404 was written expressly for those desiring a basic introduction to plastics. It is an informative textbook covering types of materials, methods of molding, etc. If you have plans for establishing a molding plant, you should get a copy of bulletin 4404.

Bulletin 4403 describes and illustrates the standard line of H-P-M semi-automatic compression molding presses. Colored diagrammatic circuit drawings clearly illustrate the various press actions. A complete list of specifications covering each size of press is also included.

Bulletin 4502 is a comprehensive bulletin covering the H-P-M 100-H-4 (four ounce capacity) plastics injection molding machine. This bulletin is profusely illustrated with typical thermo-plastic moldings made with the 100-H-4 machine. Complete specifications, including die space drawings are included.

Bulletin 4503 provides a complete description of the H-P-M 250-H-9 (nine ounce capacity) injection molding machine. All important machine design features are illustrated with sectional drawings. Plastic parts molded with the 250-H-9 machine appear on several pages, giving the reader typical production data.

Bulletin 4405 depicts the construction and design features of the H-P-M 350-H-16 (16 ounce capacity) injection molding machine. Complete engineering specifications including sectional die drawings of the straight-line hydraulic mold clamp, injection chamber and feed unit are included.

Bulletin 4601 describes the new revolutionary Turbojector for injection molding of rubber. One section of the bulletin is devoted to the design and operating features of this machine. Molded parts made with the H-P-M Turbojector are illustrated, and complete production data concerning these parts is included.

REVOLUTIONIZING PRODUCTION WITH HYDRAULICS SINCE 187

HPM

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PLASTICS MOLDING PRESSES

JUNE, 1946

plastics

VOLUME 4, NUMBER 6

in this issue

Container Fabrication, Part I.....*Mel Meyers* 21
Continuous Films: Analysis and Evaluation.....*Albert D. King* 28
Forticel in the Field..... 32
An Interpretative Survey of German Plastics Fabrication, Part III.....*W. C. Goggin* 38
Injection Mold Design, Part II.....*John G. Robb* 44
Silicone Resins Aid High Temperature Insulation.....*R. F. Horrell* 50
Report on SPI National Conference..... 56
Testing the End Product.....*H. R. Sjostedt* 58
Automatic Box Folding.....*William Schack* 62
SPI's West Coast Exhibit..... 65
Blanking Thermoplastics..... 66
Pliobond: A New Adhesive..... 74
Packaged for Preservation..... 76

departments

Plastics in Perspective..... 18
On the Drafting Board..... 49
Plastics at Work..... 72
What's New in Plastics..... 78
Literature Review 80
Engineering News Letter..... 83
Industry Highlights..... 85
People 87
Plastics Overseas..... 89
Association Activities..... 91
Statistical Data 92
Problems in Plastics..... 93

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COVER

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The octopus above is an example of what we mean. Each part of the creature represents a plastic success story for Continental's Plastic Division. The body, as an illustration, is a plastic dust cover. The nose, a plastic shoe tree handle. And so on.

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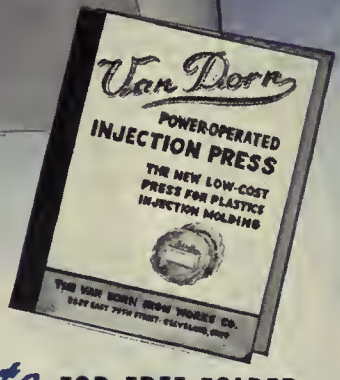

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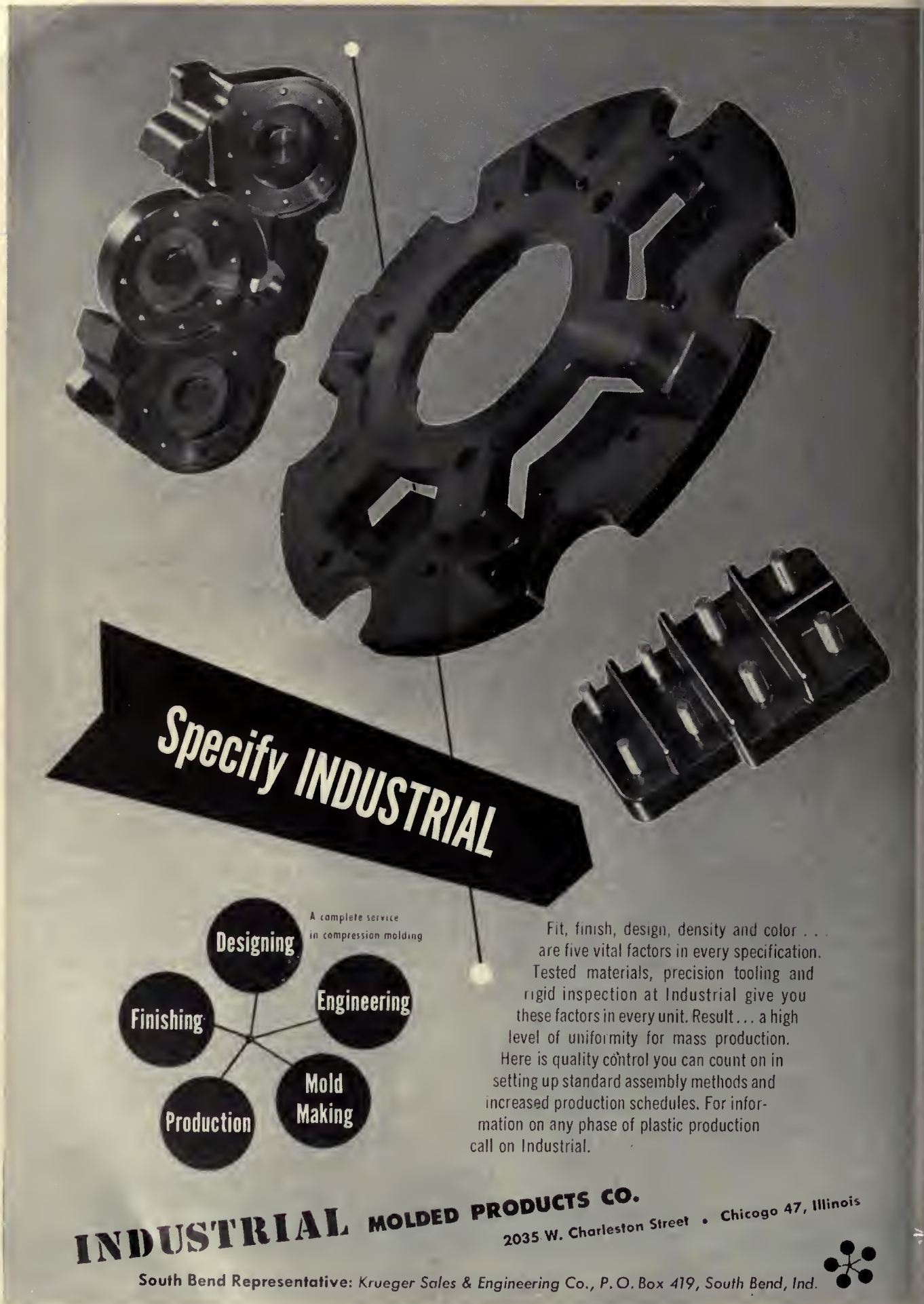
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PLASTICS in PERSPECTIVE.....

COMMENTS from the exhibitors at the First National Plastics Exposition held in the Grand Central Palace, New York City, on April 22-27, tend to bear out the general consensus that the success of the exhibit surpassed the most optimistic expectations.

Typical remarks gathered in a survey of the exhibitors included these general expressions of opinion: "very successful from every viewpoint," "show proved one of the most profitable in which the company has exhibited," "well satisfied with the entire show," and "a worthwhile show."

From the viewpoint of business obtained, a molder reported 46 leads for actual molding jobs from established companies which it is following up, another said that several very good customers were made at the show, a fabricator reported writing a good deal of business for South America, a machinery manufacturer sold a press from the floor to a Mexico City firm, another manufacturer of molding presses had "export inquiries from all over the world," and still another machinery manufacturer took orders for at least ten preforming machines. A company of decorators on plastics and glass containers reported "orders from its exhibit sufficient to tie up its production capacity for the next six months, and there are hundreds of inquiries still to answer." A laminator reported one order alone which, if material were available, would go a long way toward defraying the cost of exhibiting.

The lack of materials touches the Exposition's one unhappy aspect, brought so acutely to the fore as it was by many exhibitors' having to turn down orders because of materials shortages. Furthermore, there was little encouragement for immediate marked relief in the talk given by W. Stuart Landes, PMMA president, before the Annual Conference on April 23.

An unusual number of exporters and foreign buyers attended the show. An exporter with a booth was visited there by foreign representatives from many countries who followed up the visit with letters and calls to the exporter's offices. A materials manufacturer had "many inquiries from foreign representatives for materials and products for export." A fabricator reported numerous inquiries from exporters, but added rather dolefully that his company was not interested in them at present.

Of no small importance was the dissemination of ideas at the show, and many companies say that possibilities for the use of their materials which they had never thought of were suggested to them. One molder referred to "ideas submitted by what may be called free lance inventors," a fabricator found that "new users in fields we had not heretofore considered as market possibilities showed great interest," and other companies commented on the opportunity at the Exposition for their employees to talk to their customers and to exchange ideas with them. A toy manufacturer received numerous suggestions for toys that could be made of plastics.

Laminators were not conspicuously present at the exhibit, which makes this comment by a laminator of especial interest: "In the main, I believed we gained a good bit of nice publicity from the exhibit and feel confident that resulting business will more than offset the cost. . . . We are glad that we were represented."

Among the values which one molder thought his company received from the Exposition were the following: (1) several important new markets for plastics resulting from changing values in the older lines were discovered; (2) many important prospective customers were developed as a result of the exhibit of transfer molded products; and (3) an invaluable interchange of ideas was achieved through interviews between the company's engineers, licensees, and customers.

Other less typical comments included: "astonished to find that there were more significant inquiries on the paying days than on the so-called trade days," and "impressed by interest of middle-aged people, who would be expected to be conservative in their tastes (interest of the young is natural)."

Although praise of the show was so overwhelming in the comments as to be almost 100%, one constructive criticism for the betterment of the next Exposition was suggested by a considerable number of exhibitors. It was that the first day be reserved *strictly* for the trade.

The first exhibit was not over before the exhibitors were talking of a bigger and better show next year. The following comments are typical: "very much satisfied and will have booth at next show," and "expect to take twice as much space next year."

Further, it might be added that the Exposition brought the industry into the national eye as never before. Newspapers gave it important notice, as did the radio. Significantly, too, the newspapers carried their stories on the business and financial pages instead of on the feature pages and in the Sunday supplements.

The Exposition served to bring home to the industry itself, as well as to the general public, the great extent to which plastics have entered into the daily lives of the American people, whether at work, at play, or at rest, whether in the office, on the playing fields, or in the home. And the hundreds of new products shown and the promise of many hundreds more to be developed bear prophecy that the industry is on the threshold of a brighter future.

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The beading of cylindrical containers by the groove method, which is usually a wholly manual process, has been here largely mechanized.

Container Fabrication

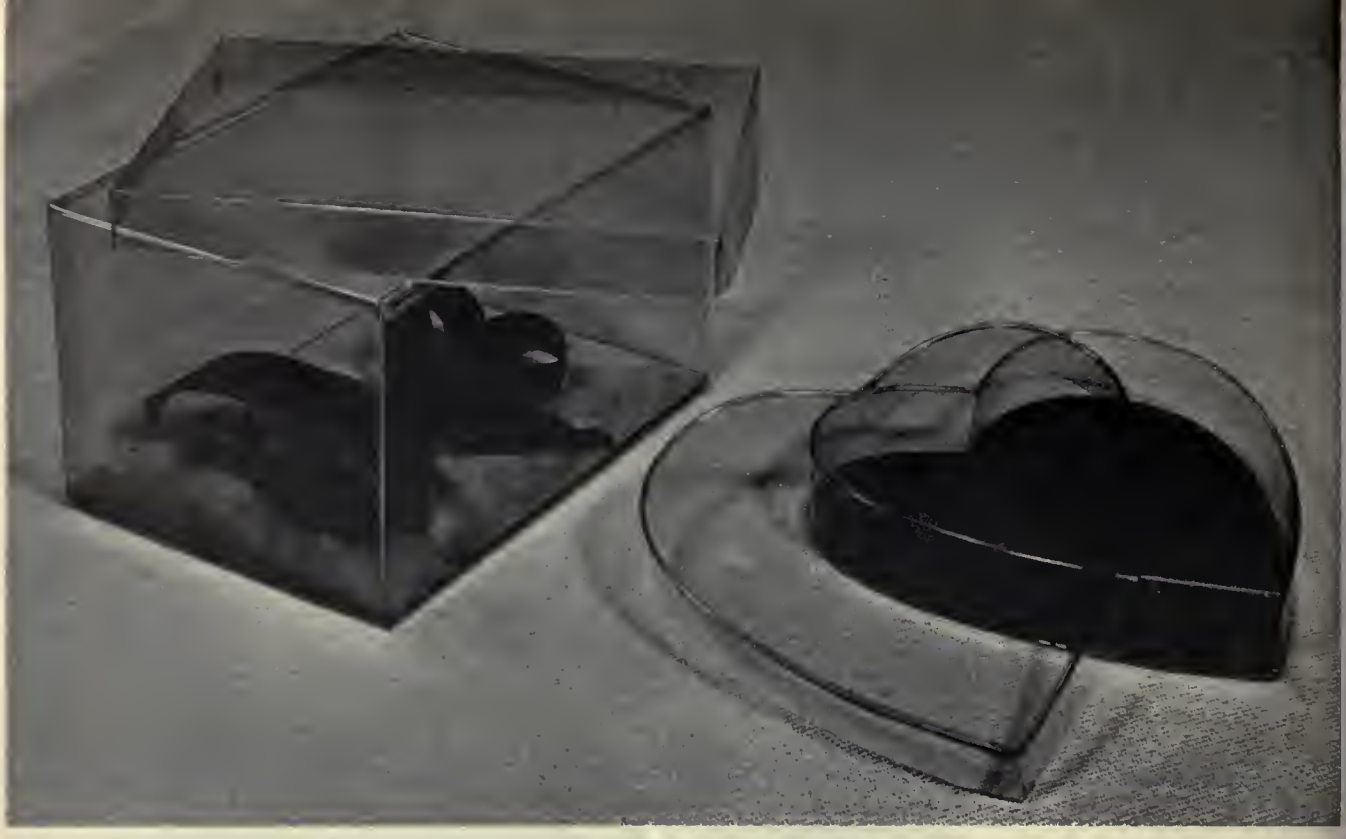
Part 1. There are many possibilities for mechanizing the process of manufacturing containers from rigid plastics sheeting

By Mel Meyers

NO FIELD of plastics fabrication is gaining more momentum than the manufacture of containers from rigid sheeting. The demand, already substantial before the war, is increasing at a rate that shows indications of outstripping production facilities. Once materials are at normal availability, production inadequacies will be due, as they are today, not only to the small number of plants in this field, but, even more, to the dearth of fully automatic machinery for the replacement of manual and semi-automatic processes now prevailing. As compared with plastics molding, the mechanization of operations in rigid sheeting container manufacture is still, except for the one process of drawing, in a pre-adolescent stage. It is the aim of this discussion to point out where the mechanization requirements lie and out of what processes in vogue today they must develop.

The term "automatic device" is generally loosely applied. To maintain consistency of meaning in this discussion, an "automatic process or machine" is defined as that which eliminates hand or foot actuation of an operation and replaces it with a mechanically actuated rhythmic repetition or a continuity of operation. Automatic blanking, as an example, is rhythmically repetitive; spiral winding is continuous. Feeding to an automatic machine may be, and usually is, manual; and that is where one of the problems lies. For a whole fabrication process to be continuously automatic, each individual operational step in the sequence of operations must itself be automatic and all of the steps must be tied together in uninterrupted continuity. At present there is only one such continuously automatic fabrication of rigid sheeting containers—the drawing (forming) machine developed by the Celanese Corporation of America, which will be discussed later.

Though neither an accepted definition nor a standardized



Folded type of container (left) and variation, both made by Central States Paper Products from cellulose acetate

range of gauges exists, "rigid sheeting" may be understood as that plastics material which, while flexible in flat unfabricated sheet form, provides a reasonably rigid structure when fabricated for use. The range of gauges in normal use for containers of rigid sheeting is from .005″ to .020″. By far the predominant range in container making is from .0075″ to .010″. At present, cellulose acetate and ethyl cellulose are the only materials in wide use for the manufacture of this type of container, with cellulose propionate, recently introduced by Celanese under the trade name of *Forticel*, seeming to have the characteristics for making it a likely contender in this field.

The manufacturing processes in rigid sheeting container fabrication are totally different from those in the making of the molded container and, except for an occasional operation, from those in the machined container. Regarded from the viewpoint of fabrication method, four types of rigid sheeting container prevail: the folded container, the longitudinally seamed cylindrical container, the spiral-wound container, and the drawn container. While this discussion treats basically of the all-plastics container, those made in combination with paper or metal follow these fabrication methods with some variations in attachment of parts, as in the spinning or crimping on of metal bottoms.

Operations Involved

Some operations are common to several of the fabricating methods. Cutting or slitting, for instance, must be applied at some point to all of them. Beading may make its appearance in any of them. A few of the individual operations have been made automatic, but not, by any means, a sufficient number to provide the field with the mechanization that it needs. Where the weaknesses lie and where the mechanization possibilities appear will become clear from a study of the operations involved in fabricating each container type.

Where the material is in flat sheets, the sheets are built up to a stack or "lay" and cut to size with a guillotine type of knife cutter, the simplest form of which for production purposes consists of a heavy blade whose cutting edge descends on the stack at a 15° to 20° angle, makes its cut and recoils. A number of types of this machine are on the market. One of the newest and most refined is a semi-automatic that includes the following features: two-handle control, so that both of the operator's hands are safely engaged during the cutting stroke; power-moving back gauge; positive clamping pressure; and, of especial importance in large production, a pre-setting gauge that permits advance setting for successive cuts of like or unlike widths from 1″ up and thus makes possible automatic advance of the stack to be cut.

Guillotine knife cutters usually require a special knife-grinding machine as an auxiliary. In steady operation, the blade will dull in a few days, the retention of sharpness depending largely on the thickness of the sheets operated upon. Most blades have a double bevel—30° immediately off the cutting edge and 25° beyond that. In addition, there is a land of about .002″ off the cutting edge toward the rear flat of the blade. A blade of this design, well ground and operating in a well-constructed machine, can cut to a tolerance of 1/64″ and better. Accuracy will, however, depend partly on stack height, which is normally decreased as the thickness of the sheets composing it increases. In the gauges under consideration here, those from .005″ to .020″, the height of the lay would normally be from 6″ to 3″.

An entirely different method of cutting is that of slitting rolled sheeting to required width as it comes off a reel and of rereeling it as strips. This method is essential in the fabrication of the spiral-wound container and in the automatic drawing machine. In fact, rolled-strip feeding may be looked to as the logical method of feeding to continuously automatic operation as it develops in any of the fabrication procedures for rigid sheeting container making.

Two types of slitting machines are available, the rotary-blade slitter and the razor-blade slitter. In both machines, the distances between the blades, which determine the widths of the strips cut, are adjustable by insertion of spacers. The means for feeding the stock off the roll and past the blades and the means for rerolling the slit strips are essentially the same for both machines. The sheeting,

unrolling from the shaft on which it is mounted, passes under a brake roller, then over and under idler shafts before it meets the blades, and then, after slitting, is rerolled on reels mounted on driven shafts.

In the razor-blade slitter, the spaced blades, usually of the long Durham-Duplex type, are stationary and the sheet moves "through" them for slitting. In the rotary-blade slitter, the spaced blades rotate to effect the cut. Gauges up to .002″ may be cut on the razor-blade slitter and up to .015″ on the rotary-blade machine. Feed rate must diminish as the thickness of the material increases.

Both of these machines may be regarded as continuously automatic for the operation of slitting, since hand operations are eliminated except for changing the roll on the feeder shaft and demounting the rereeled strips.

The blanking operation is common to several methods of container making. In making folded containers, for instance, it is required for forming flanges for seating cemented bottoms or making cemented corners. In making longitudinally seamed and spiral-wound containers, it is required for blanking out bottoms for seating on the bead. In the gauges generally used for containers of rigid sheeting, blanking is done cold, that is, with the sheeting at normal room temperatures. If the stock to be blanked is colder than about 65° F, it should be permitted to warm to that temperature before blanking. The operation is executed with either knock-out or open-faced dies mounted in a foot-press of the type seen in an accompanying illustration. The dies are ordinarily made of about .30″ high-carbon steel. On the knock-out type of die, the cutting edge is sharpened to about 15° and the chamber of the die is provided with a spring, a spring-impelled pin or a sponge-rubber pad for ejection of the blanked piece. In some blanking operations, a disadvantage in knock-out dies is that the blanked piece requires removal from the stock by hand. Where this occurs, an open-face die is used. This tool is so constructed that the blanks are picked up into the chamber of the die as they are cut and are retained there until the chamber is filled with blanks, when they are ejected by hand. To provide for pick-up, a slight bevel is ground away from the cutting edge toward the inner wall of the die and the chamber walls slant away from the cutting edge in a 2.5° deviation.

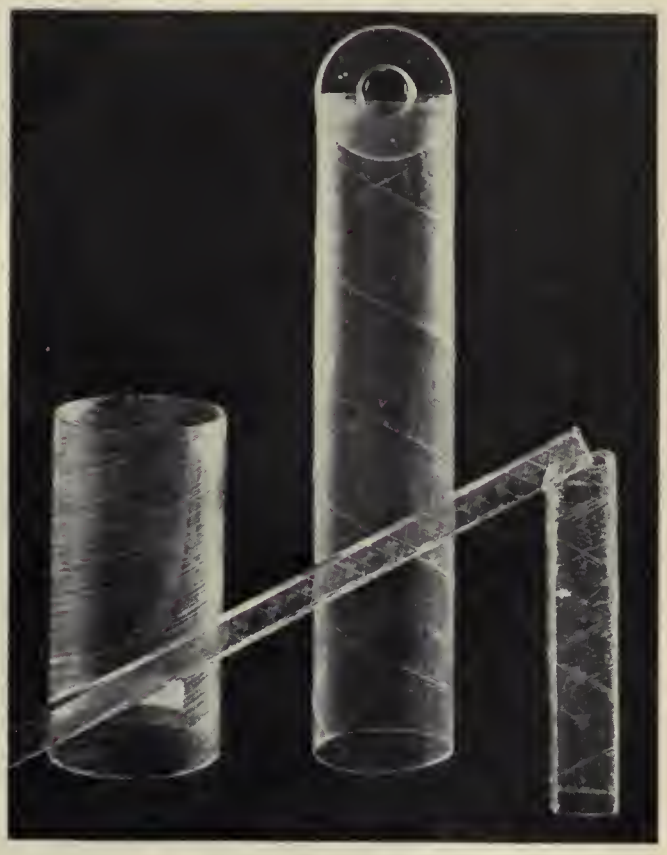
Ejection Set-up for Mass Production

The methods of ejection in both cases are inefficient for large scale production, for which a different set-up is therefore used. This consists of an automatic press, similar to the foot-press in design principle and action except that it is electrically driven and the operation is repetitive at a pre-set rate. The die set-up includes a nether female die, through the chamber of which the blank drops to a collecting receptacle, eliminating hand ejection methods. Feeding to this automatic machine is still generally manual. Either blanks are separately fed or a roll strip is hand-guided to the die. The interposition of a hitch step between roll and die would render the whole operation continuously automatic.

Beading may appear on all four types of container (except for the rectangular drawn piece). For the folded container, the bead is made after blanking and before folding. On the longitudinally seamed container, the bead may be made either before or after seaming, different beading procedures being used in each case. On spiral-wound containers, the bead is put on after completion of the tube. Bead diameters usually range between 1/16″ and ⅛″.

Hand beading of the folded container is obsolete. There are a number of good beading machines on the market to perform this operation. They provide continuous beading of short blanks or long strips and, depending upon the

Note steel reinforcement ring in bead of longitudinally seamed container at left, humidor use of that at right



Spiral-wound containers are not confined to round cross-sections, single plies of sheeting. Up-ended cap (above) is a drawn piece. The rectangular drawn container (below) shows near-limit of present-day draw ratio, which is 1-1

thickness of the material, the best of them can produce from 200 to 350 linear inches of bead per minute. The double-edge beading machine—essentially no more than two parallel single-edge beaders with a common table plate, the whole set-up being adjustable for distance between edges—is capable of simultaneously forming over- and under-beads. This is of especial value in the case of containers that are both top- and bottom-beaded, the bottom bead turned inward for seating the container bottom and the top bead turned outward to provide a lip.

Combining Operations

The beading machine is in itself automatic, but, as used now, it is a dissociated operation and generally either hand-fed or hand-guided. A considerable step toward combined operations could be taken by providing continuous feed at one end of the beader and automatic cut-off to length at the other, thus realizing fully the potentialities of the continuous beading machine. A problem involved in continuous roll-feed to the beader is that the hold of the beading wheels on the edge of the sheeting is too light to sustain the pull needed to draw the material off the roll, especially off a full roll. The solution obviously lies in interposing, between the roll of stock and the beader, a pair of feeder rolls tensioned to advance the stock to the machine freely. A braking device on the stock roll would prevent the strip from whipping. The cut-off arrangement at the terminal end of the set-up would require that the blade travel synchronously with the beaded strip, but the principle of this cut-off device should present no more difficulty than that of a cut-off unit for the spiral-winding machine, described below.

Beading before folding and seaming presents two disadvantages for which the present mechanical status of the industry offers no cure. One is that, when the fold is made through the bead, a small sharp peak, rising above the level of the bead, is thrown up at the corner. The other and, from the viewpoint of production economics, the more important, is that relatively high time-labor is involved in telescoping the bead ends at the seam.

For the folded container, there is no way out of this difficulty as yet. For the cylindrical container, whether longitudinal-seamed or spiral-wound, there is a mechanically simple alternative. It can be visualized in this way: if the lower round plate of the motor-driven groove-beader shown in the photograph on the first page of the article were taken off and placed on a hot-plate, there would be a complete set-up for the beading of a cylindrical container. The plate, which is of brass, is a die formed by machining a circular groove into its surface. Cross-sections of plate and groove are shown on the next page. The depth of the groove and its width across the top equal the diameter of the bead to be obtained, plus twice the thickness of the material. The operative side of the groove inclines toward the trough at an angle of about 60°, while the other side may incline at an angle of from 20° to 30°. The diameter of the trough cross-section will depend upon the diameter of the bead to be formed. The direction of curl of the bead will be determined by the direction of incline of the operative side of the groove, as may be seen from the sketch, where *a* is for an inward curling bead and *b* for an outward curling one. The die is kept heated to a temperature of about 230°F for material of .010″ thickness or less and may go up to 270°F for heavier sheeting.

In the hand version of the operation, the tube of sheeting is mounted snugly on a mandrel, with as much of the tube extending beyond the mandrel as is needed to form the bead. The extended edge of the tube is pressed lightly into the hot groove of the die, and the tube is turned slowly until a bead curls.

This operation has been mechanized by the groove-type beader shown in an accompanying photograph, which is a

Notching, preliminary to corner seaming, is done on a foot press similar to type used in blanking

Tub-Proof, Tot-Proof

HIS Noah's Ark molded of Tenite is excellent proof he toughness of the mate- Tenite easily withstands the ging, dropping, and ungentle tment to which such a toy ubjected. And the molded ite cradle in which the ark s in dry dock is strong ugh to double as a scooter kate, if the owner so desires.

he buoyant Tenite hull, ghted with metal to prevent om capsizing, floats easily is completely watertight. ite has low moisture absorp-, and water does not mar or its lusttous surface.

he Tenite atk is made in erful, attractive colors — colate brown for the hull, ming white for the cabin, brilliant red for the shingled f and gangplank. A per- ient part of the Tenite, these ors cannot chip or peel.

enite is the material of many er favorite playthings—doll ds, whistles, and music ers, toy soldiers, boats, air- es, and automobiles—all of ch may be mass-produced minimum of time and at ively low cost. For infor- ion concerning the adapta- y of Tenite to your product, te TENNESSEE EASTMAN PORATION (Subsidiary of tman Kodak Company), GSPORT, TENNESSEE.

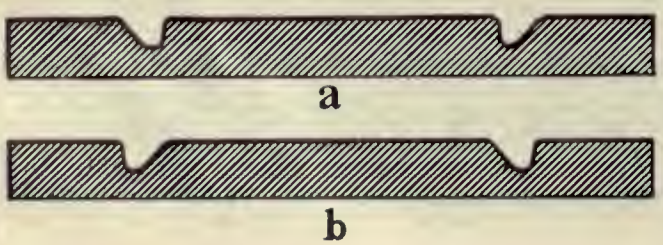
Tenite Noah's Ark molded by Amos Molded Plastics for Amatoy Corporation

TENITE AN EASTMAN PLASTIC

Although individual blanks are being fed here, this machine is often used for continuous beading of long strips

redesign made for its own use by the See-Thru division of the George V. Clark Co., Inc., New York, in whose plant all the operations pictured with this discussion were photographed. The design considerations and construction of the die used in this machine are exactly the same as in the one for hand operation. The mandrel is eliminated and the hand pressure is mechanically reproduced. The tube of sheeting is placed in the groove of the die (lower plate), which is kept hot. The die plate rises so that the tube is caught between it and the upper stop-plate. The die-plate continues its advance, forcing the softened tube edge down into the groove and curling the edge into a bead. Then the die-plate retracts and returns to rest. The whole cycle is cam-actuated.

For double-edge beading, the top plate is also grooved as a die plate and heated. Lift, however, is confined to the lower plate. In the Clark machine, the twist action of the hand-heading operation is dispensed with, since it was found unnecessary in the work for which it was used. It can easily be incorporated, however, by a simple cam attachment to provide a partial revolution of the die-plate and return. Where there is double-edge beading on a large piece, twist action may be shared by upper and lower die-plates, with a cam engagement for each that will turn them in opposite directions.



Cross sections of plate and groove, suggesting how cylindrical container bead ends may be telescoped mechanically

Morton Lambert, in charge of production for the Clark firm, finds that, for quantity runs on longitudinally seamed cylindrical containers, this groove method of production after seaming is far more economical than machine beading before seaming. Since a cementing operation is present in both cases, the comparison of operations lies between the time taken to telescope the bead ends in the case of the pre-beaded tube and the time taken to groove-curl the bead in the pre-seamed tube. The groove-made bead is favored by a considerable portion of a minute.

Coming into the market is a largely automatic groove-beading machine, in which all the basic principles of the hand-beading process and of the machine operation described above remain the same, but in which production rate is increased by a mechanical feed of tube to groove. The tubes are arrayed on a turntable, from which they are slid onto the die-plate and into the beading groove by a pusher rod that has a vertical motion for dipping into and out of the tube and a lateral travel to slide the tube to the die-plate.

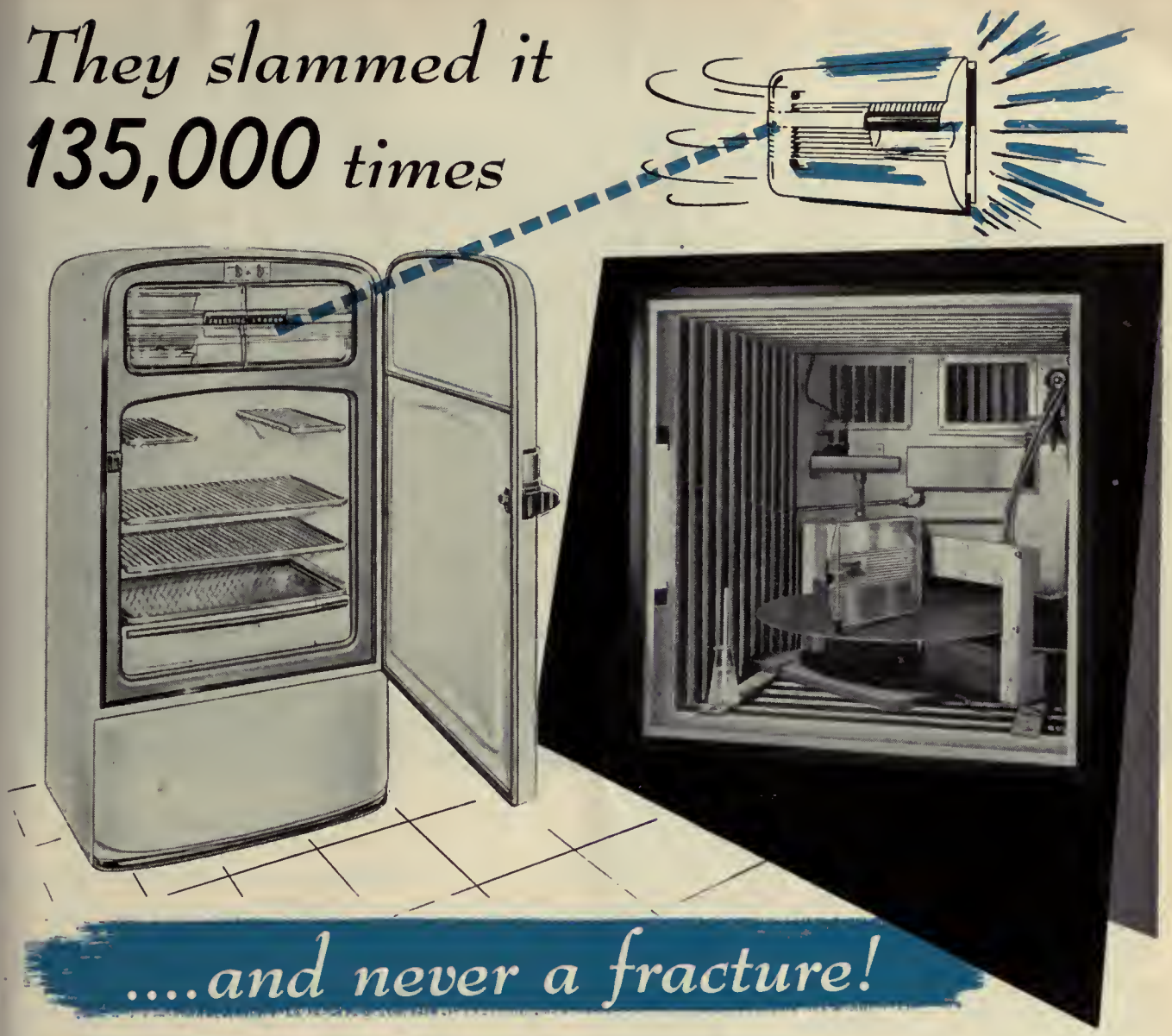
Enclosing a Reinforcement Ring

An interesting application of the groove method of beading is the inclusion of a steel reinforcement ring within the bead. In fact, the only way in which a fully rigid ring can be enclosed in the bead is by the groove method. One procedure is to drop the ring into the groove before the tube edge is applied and then to let the curling edge pick up the ring on its way. For heavy rings, however, Mr. Lambert recommends first partially curling the bead (to somewhat less than 180°), passing the ring down the cylinder and dropping it into the half-bead, and then completing the bead.

A missing link in the production of containers of rigid sheeting is a bead for a drawn rectangular container. There is no available method for accomplishing this. And yet, entirely aside from being more attractive than a raw edge,

(*Continued on page* 111)

They slammed it 135,000 times



....and never a fracture!

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"Specs" called for a pair of transparent doors for the frozen food compartment of the refrigerator. It was a natural for plastics and the job was entrusted to CMPC. A transparent polystyrene material was selected, molds were built, and a test run made by injection molding.

Then Admiral engineers wanted to know how these doors would stand up under actual use. Would extreme cold make them frangible? Would continued use weaken them? They designed and built an automatic "door slammer" which snapped the door shut 22 times per minute. At room temperature they slammed it 85,000 times with no sign of fracture. And since normal use of the door is approximately 15 times per day, this test is equivalent to 15 years of use.

Following this, another test was made . . . 50,000 "slams" of a door in a cold chamber at temperatures from 5° above to 10° below zero F. Again no fracture. We believe these tests are rather conclusive, and certainly indicative of Admiral's desire to insure satisfactory operation far beyond the requirements of normal use.

We like to work with customers like Admiral . . . those whose ideals coincide with ours . . . who insist upon quality, dependability, and long life in everything they build. That's one reason why so many manufacturers come to CMPC for molded plastics . . . why you, too, will find it worthwhile to discuss your plans with a CMPC Development Engineer.

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COMPRESSION AND INJECTION MOLDING OF ALL PLASTIC MATERIALS

Continuous Films

By Albert D. King

Consultant, Electronics and Chemical Engineering

EMINENT progress in the development and use of continuous plastics film makes especially appropriate at this time a general review and evaluation of the whole plastics film situation, including pre-war status, war-time development and usage, current position, and future possibilities.

Before the war, the number of plastics available in the form of continuous films was limited, though a considerable variety of materials was to be had in sheet form only, in sizes not larger than 20″ by 50″. Today, as a result of the efforts of manufacturers to meet the demand caused by increasing applications for continuous films, many of the materials formerly available only as sheets are now to be had in continuous lengths.

Aside from the development of new applications, there are four factors which will increase the use of continuous plastics films. First, the number of plastics available in film form increased with the war because of the need for films with specific properties and because their use required a volume sufficient to warrant the development of continuous production methods, which have taken plastics with the desired properties and made them into films. Ethyl cellulose film, because of its toughness, became available for war applications where cellulose acetate film, with its comparative lack of toughness and its greater sensitivity to water, was undesirable. For radar equipment, a film with exceptional electrical characteristics was necessary, and polystyrene was extruded and stretched into thin continuous films to meet this need.

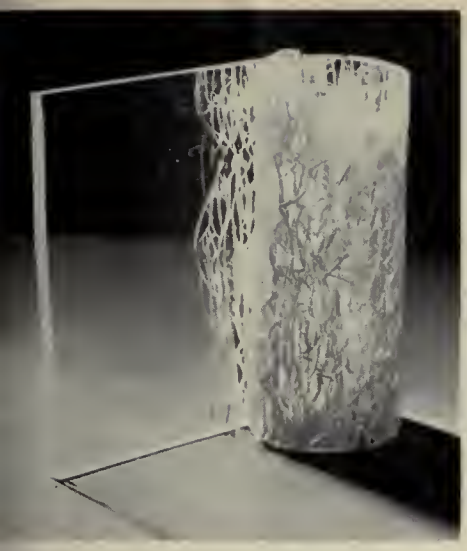
Today most plastics can be produced in film form, for the art has advanced to the point where such plastics as polyvinylidene chloride can be made into films with the orientation necessary for high strength. Polystyrene can be produced without solvent, and vinyl films can be calendered down to 0.001″ thickness. Even continuous thermosetting films are being made today from allyl copolymer type resins by still-secret processes.

Second, film formulations have been improved to the point where their use in certain applications is now warranted. The ability of cellulose acetate film to resist deterioration when exposed to sunlight with its ultraviolet rays, as well as exposure to rain, has doubled in the past five years through the proper choice of plasticizers and by the incorporation of small amounts of anti-ageing compounds, similar to long-established practices in the rubber industry.

Mixing Materials Improves Film

Another means used to improve the present film formers is to mix two or more plastics, the result being that the undesirable characteristics of one are lessened without sacrificing its good properties. For example, polyvinyl butyral resin makes a tough, flexible, heat-scaling film. Unfortunately, the plasticized polyvinyl butyral tends to "block" or stick when two thicknesses are allowed to remain in contact under pressure. Early Army raincoats gave this trouble when rolled up, especially if stored in a warm place. This was overcome by including a little phenolic thermosetting resin in the mix. After this combination was formed into a film and once subjected to heat, the material lost its tendency to "block." It can also be heat-sealed before being subjected to the high temperature, but the ability to seal is lost after the material is heated.

On the other hand, when this film is used where heat-sealing is necessary during the life of the article, the practice of incorporating larger amounts of certain other thermoplastic resins is used. The "blocking" temperatures and pressures



Rolled "Butacite" showing shattered glass particles adhering to flexible interlayer

Lingerie and other items are easily identified, kept clean, in Seal-Sac transparent containers made of polethylene extruded by the Plax Corp.

are raised enough to allow normal use of the film, while the material still retains enough of its heat-sealing characteristics for fabrication with standard sealing equipment.

Large amounts of this mixture of thermoplastic resins were used with lead foil laminated to paper or to paper and cloth for wrapping many types of munitions and machine parts. The plastics film is produced directly on the lead foil to protect the lead against abrasion and to allow heat sealing. On the other side of the lead, before applying the plastics film, paper is laminated with a synthetic rubber adhesive. Where greater strength is desired, the lead-paper combination is laminated on the paper side to an open weave textile material, using polyvinyl acetate as an adhesive.

More Characteristics Now Available

The development of special techniques to produce films of certain plastics with standard film-forming equipment, thus making more films with a wider variety of characteristics available for the designer and engineer, is a third factor which will increase the use of films in the coming years. Coupled with this is the increased availability at low cost of materials and equipment necessary to produce special films. These items do not appear in an obvious way in the finished product, but they strongly influence the practicability of the production of plastics film.

It is the general aim of all plastics material manufacturers to reduce the cost of their products so that they may be used in a wider field, which, in turn, means larger volume and decreased cost. The war has accelerated this trend by stimulating the building of large units to produce chemical and plastics components. To utilize the large production volume in peacetime, the market must be wide and the price low.

Along with reduction in production costs, the raw materials prices have come down with the volume production achieved for war purposes. This is the fourth factor which will enhance the field of continuous films in the future. Even further reductions in the price of polystyrene can be anticipated, because of the large production capacity of the monomer built for the synthetic rubber program. Other plastics such as the vinyls have experienced a manifold increase in volume, and the desire of the manufacturer to produce at full capacity will lower prices.

These four factors will soon make available many more films with a greater variety of characteristics than the designer and engineer had to work with before the war. Film use is limited principally to the number of ideas for their application which are envisioned by the designers of prod-

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Strength, rigidity, dimensional stability of "Ethocel" sheeting make it ideal for sealing compound containers

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uets and processes. While the ideal plasties film has not been developed, the range is now so great that satisfactory characteristics can be seleeted from the available plasties.

Before the war the large volume films were made from eellulose nitrate, eellulose aeetate, vinyl butyral, and eellophane. The largest use of nitrate film was in eommereial 35 mm motion picture film, while the aeetate was expanding in deeorative packaging, amateur motion pieture "safety" films and novelty items suеh as lamp-shades. The vinyl butyral held a monopoly on the safety glass applications. As everyone knows, eellophane had its use in paekaging and as a deeorative item.

In the eoming years, we may expeet to see eellulose triaeetate or eellulose acetate-butyrate film replacing the nitrate material as the commereial motion pieture film. This displaeement need not, however, alarm the nitrate field, sinee new uses are being found daily for eellulose nitrate. Imitation marble table tops are being produeed photographieally on the inside surface of a nitrate film, whieh is then laminated to a suitable supporting surfaee. Entire rooms are being paneled by the same proeess, giving the appearanee of stone, briek, or expensive wainscoting.

Doubtless the volume of speeific plasties films will fluctuate, may even drop to a very small figure at times, but overall film produetion will increase greatly. The history of some of the films illustrates this point. Nitrate film was first produced for suеh things as eelluloid collars and motion picture film. As the picture industry grew, disastrous fires oeeurred beeause of the film's great susceptibility to combustion. A shift to eellulose acetate resulted, but this trend was halted when the slow-burning cellulose nitrate film was introduced. Despite the greater fire hazard, the eellulose nitrate held its own because of its dimensional stability, resistance to moisture, and laek of brittleness. New uses will likely continue to be found for the nitrate film beeause of its desirable properties and its low priee.

Acetate Film

Cellulose aeetate film has also had its ups and downs. Its first development was for the photographie industry as amateur motion pieture film. Later it replaced a large volume of nitrate film used for X-ray photographs beeause of the danger from fire and gas when large volumes of nitrate film are stored. The death of twelve doetors and teehnieians in a hospital X-ray film storage ehamber fire speeded this change. Again, the eellulose aeetate replaeed the nitrate as the early safety glass interlayer. The yellow windshields of some of the older automobiles testify to the rapid ageing

(*Continued on page* 108)

International plastic in the call for combs!

From border to border—and beyond—manufacturers in growing numbers are making full use of the special advantages of Styron in the production of quality combs. The millions of users of Styron combs—in the United States, Canada and Mexico—know only, perhaps, that they obtained a useful, attractive product at a price they could afford to pay. But the makers of these combs know that customer satisfaction (and their own success!) stems from the inherent excellence of this Dow plastic as a molding material. They know Styron offers good dimensional stability, smooth surfaces, resistance to acids and alkalies. They know Styron can be made beautifully clear, translucent or opaque and that it has unlimited color possibilities. They know Styron's light weight means more pieces per pound and that, combined with low price, this gives maximum manufacturing economy. They know that, in combs and many other products, Styron is the name you can *depend* on in plastics!

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PLASTICS

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Bending "Forticel" comb to an extreme curvature illustrates its strength and toughness

Forticel in the Field

Thorough field evaluation not only validated original test data, but revealed properties not discovered in laboratory

SINCE the development of the new cellulosic plastics *Forticel* was announced by Celanese Corporation of America in December, 1945, the company has followed up laboratory test data to see how they stand up in the field. In laboratory molds, *Forticel* consistently gave parts with a higher surface luster than other cellulosic materials. Basic physical tests on standard specimens indicated that it was possible to obtain a high level of impact strength and at the same time to maintain good surface hardness, stiffness, and tensile strength. In addition, excellent moldability and fast machine cycles were also realized. Basic laboratory tests further showed that its water absorption was very low and that its dimensional stability was excellent. Repeated cyclic ageing tests as a measure of stability gave shrinkage values which were among the lowest recorded for a large variety of esters of cellulose.

However, since not all of the problems of handling a new material can be predetermined by laboratory testing alone, a comprehensive program for field evaluation was initiated. It was planned so that the material would be test molded in a wide variety of injection molding machines, with various mold designs. Considerable attention was also given to the selection of those items which, because of their intended use and application, demanded physical properties *Forticel* was believed to have.

This article is based on a paper presented by Burton E. Cash, Chief, Product Development Section, Celanese Corporation of America, at the recent annual conference of the SPI in New York, supplemented by a discussion of the chemistry of *Forticel*.

Some parts thus tested were toothbrush handles, combs, optical frames, safety goggles, industrial housings, flashlights, saw handles, large screw driver handles, and fountain pens. Careful records of moldability and machining qualities were kept, and molded parts were brought back to the laboratory for comprehensive testing of strength and dimensional stability.

Although laboratory molded parts showed highly finished surfaces, it was not until extensive field molding had been done that this was recognized to be an important property of the material. Almost without exception, the surface from the die was superior to that of any other cellulosic material used, and this high surface luster was maintained over widely varying injection cylinder temperatures and machine cycles, as was not the case with other cellulosic plastics.

Cycle Can Be Decreased

Another advantage discovered in the field molding was shortened machine cycles. A two-cavity flashlight die currently operated on a 37 second overall cycle was successfully run in *Forticel* on a cycle of 27 seconds. Another example of cycle reduction was a 16 cavity toothbrush die being operated on a 60 second overall cycle. With *Forticel*, this same die ran well in 40 seconds. Cycle reduction cannot be realized, however, on every injection mold. Inserts that are removed manually often govern the minimum cycle. The cycle is limited in other cases by the rate at which the particular machine and heating cylinder can properly plastify

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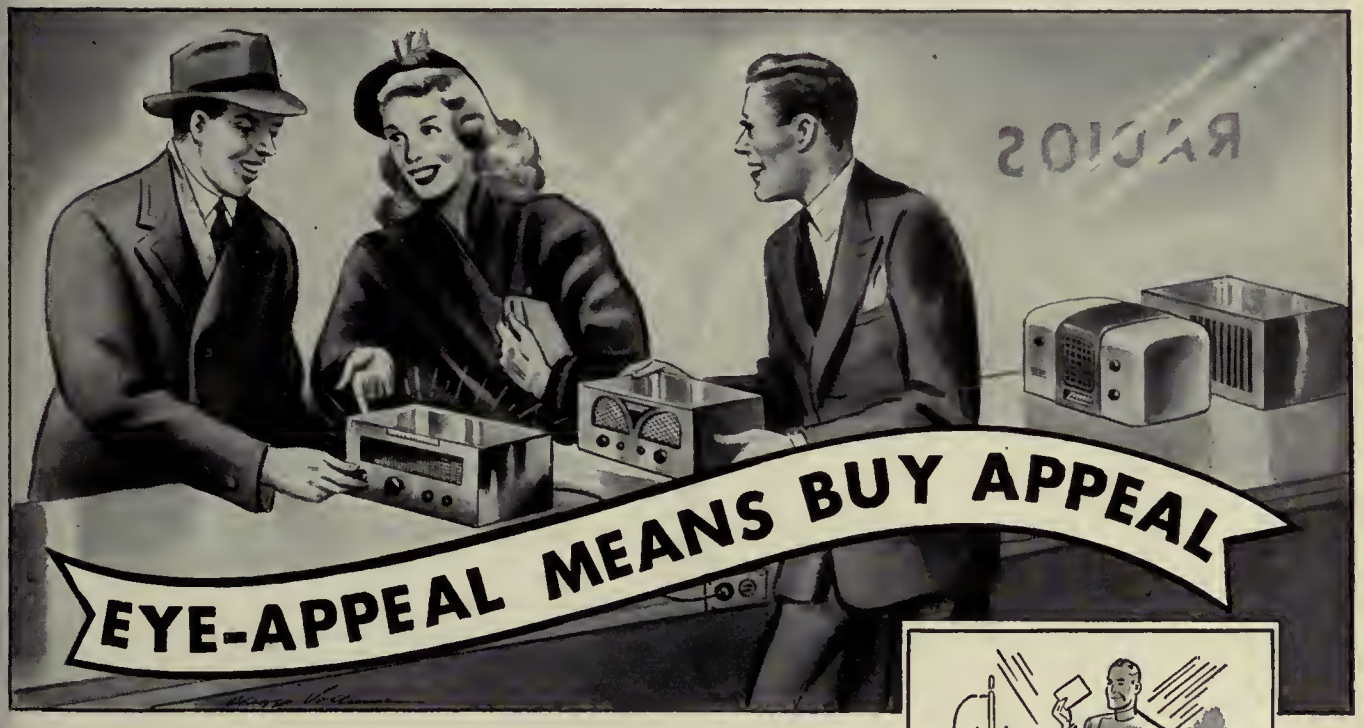

Plastics look their best, and sell fastest, when they have the added surface beauty of a very fine finish like CODUR.

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"Forticel" combs were molded in a Leominster press at the National Plastics Exposition and distributed as souvenirs

the molding material. Still other jobs of very heavy cross-section or with heavy ribbing must be held under high pressure until cooled or hardened to a certain point. This phenomenon is related to the heat transfer and viscosity-temperature relationship of the molding composition, and, in these respects, *Forticel* does not appear to differ from the other cellulosics. For these reasons, cycle reduction was not always possible, but the material in no case required a longer cycle than the standard material being used.

Compatible With Butyrate

Forticel can be mixed in all proportions with the cellulose acetate butyrate commercially available today, but cannot be mixed with any other molding material. This means that *Forticel* can follow cellulose acetate butyrate through the heating cylinder of the injection molding machine without any costly clean-outs. These facts are important also because they govern the separation and classification of scrap and indicate the care to be exercised in the dryers.

During the field work, *Forticel* was found to retain its good qualities over an average cylinder temperature deviation of plus or minus 20° F, whereas other cellulosics, beyond an average span of plus or minus 10° F, suffered in either surface appearance or homogeneity. For example, a two-cavity flashlight die was operated first at cylinder temperatures of 410° and 110° F front and rear zones respectively. Both heating zones were then increased in temperature by 40° F. The flashlights under both conditions of molding exhibited a surface having a high finish, and subsequent strength and stability tests revealed that both sets of flashlights behaved the same.

Another example was a 16 cavity toothbrush mold, where a hard formula of *Forticel* was molded at cylinder temperatures varying as much as 60° F with all the other machine conditions held constant except pressure. The resultant brush handles all drilled well on high speed drilling equipment and had a very good finish.

Nevertheless, Celanese engineers stress that quality production requires that the control of molding machine variables, particularly temperature, should not be relaxed. They do claim that this wider molding range permits more rapid set-up of new jobs and facilitates the interchange of dies in different machines in a molder's plant.

Not Difficult to Mold

A table of properties of *Forticel* formulations developed to date reveals that the plastic flow range is between 302° F and 351° F. This does not mean that the molding temperatures are high or that the material is difficult to mold. It cannot be emphasized too strongly that the ASTM flow temperature is not a reliable guide to molding temperature when different plastics are being compared, although it is a reasonably good guide within the compounds of a single plastics. Actually, *Forticel* requires cylinder temperatures equivalent to other cellulose esters, having about 18° F lower ASTM flow when all other molding variables are held constant.

The machining and finishing of injection molded parts present no particular problems. In molded thin-wall optical frames, no difficulty was experienced in routing out the lens recesses on high speed routers even when the frames were molded at widely differing temperatures. Turning, punching, and tapping are easily accomplished. In the majority of cases, buffing operations can be dispensed with. Dies, it was ascertained, can be designed with smaller gates than are generally required for cellulose acetate. This feature, added to the lack of skin formation on moldings, permits easy separation of the parts from the sprues and runners. Molded *Forticel* parts can be cemented as readily as parts of cellulose acetate, but some changes in the chemical constituents of the cements are necessary because of the differences in solubility of the two plastics.

Interpreting Impact Strength

The very high Izod impact strengths determined in the laboratory on many formulations of *Forticel* needed field confirmation of their significance. Some of these figures ranged upward of eight foot pounds per inch of notch. It was learned that these high values can be related only qualitatively to the impact strengths obtained on a number of items molded in the field. In various types of housings, the moldings of *Forticel* have, on the average, shown superior shock resistance in drop tests and falling ball tests to other cellulose ester compositions. An anomaly does appear to exist, however, when comparing their shock resistance to parts of ethyl cellulose, particularly at sub-zero temperatures. When the highest order of strength is required, ethyl cellulose is still the toughest cellulosic.

Flashlights molded of *Forticel* passed a cold impact test of 12 in.-lb and 20 in.-lb at minus 10 degrees F. Other cellulose ester compositions when formulated to meet this level of strength have considerably higher shrinkage characteristics upon repeated cyclic ageing tests. In addition, flashlights molded of these materials will warp and distort under exposure to 175° F for 24 hr followed by 24 hr at 130° F and 95% relative humidity. The *Forticel* flashlights exhibiting these high strengths pass such a heat and humidity test satisfactorily.

It appears, therefore, that the exceptionally high Izod impact strengths indicate that *Forticel* is a tough thermoplastic. Although a molding with an Izod impact strength of nine foot pounds cannot be considered twice as strong as a cellulose acetate material at four and a half foot pounds, the Celanese values to date do show, however, that it is the strongest of the cellulosic ester molding materials currently in use.

The laboratory evidence of the good dimensional stability of parts molded of *Forticel* was thoroughly checked on a

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variety of field moldings. From a use standpoint, it is necessary to consider dimensional stability from two viewpoints. The first is the dimensional changes or shrinkage which takes place over long periods of time. The second is warpage or distortion.

Tests for warpage were carried out at high humidities and elevated temperatures. It was pointed out previously that flashlights molded of *Forticel* passed a combination heat and humidity test of 24 hr at 175° F followed by 24 hr at 130° F and 95% relative humidity without distortion. Another part tested was a telescoping box with dimensions of 8¼" by 3" by 1½" with a 0.055" wall. These boxes both assembled and disassembled were exposed to a temperature of 120° F and 95% relative humidity for 14 days. At the conclusion of the test, the lid and base fitted satisfactorily.

Thus, the field performance of *Forticel* has confirmed the basic laboratory findings that it possesses an excellent balance of properties.

Chemistry of Forticel

Chemically, *Forticel* is cellulose propionate. It is made by the reaction of propionic acid and anhydride with cellulose in the presence of a catalyst.* Propionic acid is a 3 carbon acid falling between acetic and butyric in the fatty acid series. It was available in only very limited quantities until the Celanese Corporation recently succeeded in developing a new process in this country for producing propionic acid from natural gas in commercial quantities and at a reasonable price. This process is in operation at the company's chemical plant at Bishop, Texas.

When the number of carbon atoms in the esterifying acid of the cellulose ester is increased from acetic to propionic and butyric, certain fairly definite relationships exist. For example, moisture sensitivity decreases and so does hardness and rigidity. Cellulose butyrate is regarded as too soft for a satisfactory rigid plastics. Probably for this reason butyric acid is used in cellulose plastics as the mixed ester cellulose acetate butyrate, which lies between the single esters in moisture sensitivity and hardness.

Practical tests confirm chemical theory in that *Forticel* has low moisture sensitivity with satisfactory hardness and rigidity. Its ASTM water absorption ranges from 1.0 to 1.7%. Moisture absorption in itself is not too important, but rather its effect on the dimensions of the molded part is important. For example, a *Forticel* piece was exposed until equilibrium was reached, first at 0% relative humidity and then at 90% relative humidity. The expansion in length due to the moisture absorbed was only 0.4%, which is not excelled by any other cellulosic plastics.

* It is thus a straight cellulose ester, not an ester of mixed organic acids. It was erroneously described as cellulose acetate propionate in an article in the December, 1945, issue of ***plastics***.

Compatibility with Plasticizers

The compatability of the cellulose ester with plasticizers and solvents increases as the number of carbon atoms in the esterifying acid increases. Thus, cellulose propionate can be formulated with a greater variety of non-volatile plasticizers than can cellulose acetate, which permits better flexibility in formulation. Cellulose propionate also requires about 50% less plasticizer to attain comparable flexural strength. The lower plasticizer level results in excellent plasticizer retention and stability on ageing.

Although the properties of *Forticel* with respect to moisture absorption, hardness and chemical compatibility could be reasonably predicted from chemical considerations, other physical properties and molding qualities could not be foretold with any accuracy. The range of properties for currently developed formulations is shown in the table.

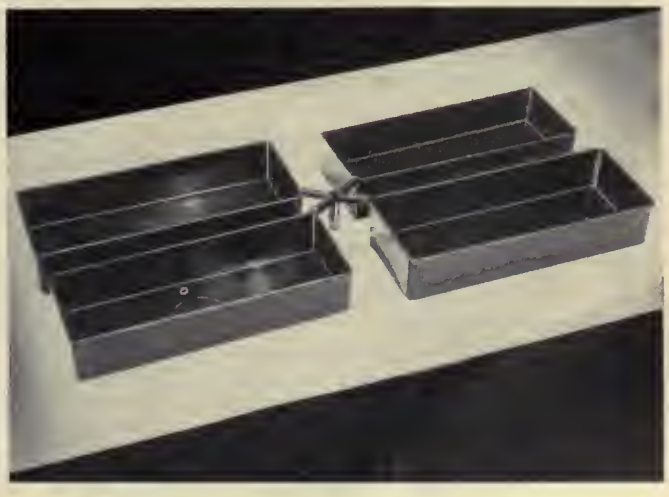
An outstanding characteristic of *Forticel* is high impact strength, as noted above. Cellulose propionate is unusual in that impact strength increases rapidly with plasticizer content in the region that gives satisfactory flexural strength, hardness and dimensional stability, while with cellulose acetate the increase is only gradual. As previously mentioned, dimensional stability under humid conditions is excellent. Resistance to warpage with increasing temperatures at high humidity is somewhat better than that of cellulose acetate butyrate but not quite equal to that of ethyl cellulose. Other properties as shown in the table cover the same range as the other cellulosic plastics.

Of particular interest to the molder are the molding qualities of *Forticel*. It has excellent flow characteristics in injection molding, filling mold cavities through small gates, making exceptionally strong welds with less evidence of weld lines and smudge than other cellulosics and with especially high surface polish. The question of flow temperatures was discussed in the first part of this article.

Forticel offers to the molder low specific gravity; unlimited color; toughness and strength; good dimensional stability; brilliant surface finish; freedom from objectionable odor; and fast molding cycles over a wide temperature range. END

Properties of "Forticel"

Property	ASTM Method	Values Min.	Max.	Typical
Flow temperature (°C)	D 569-43	150	177	161.5
Specific gravity	D 176-42T	1.17	1.22	1.19
Rockwell hardness (R scale)	D 229-43	63	104	97
Impact strength (ft-lb/in. of notch Izod)				
At 25° C (77° F)	D 256-43T	0.8	11.4	7.8
At —40° C (—40° F)	D 256-43T	0.7	1.2	0.8
Distortion under heat (°C)	D 648-41T	49	66	52
Tensile strength (psi)	D 638-42T	2,800	6,000	4,070
Elongation (%)	D 638-42T	25	43	35
Flexural strength (psi)	D 650-42T	4,800	10,000	6,730
Water absorption (%, 24 hr immersion)	D 570-42	1.0	1.7	1.4
Soluble matter lost (%, 24 hr immersion)	D 570-42	none	0.1	none
Weight loss on heating (% / 72 hr/82°C[180°F])	D 706-43T	0.3	2.2	1.5
Power factor (at one megacycle)	D 150-42T	0.019	0.032	—
Dielectric constant (at one megacycle)	D 150-42T	3.3	3.5	—



Another field job was demonstration molding of "Forticel" cigarette cases in HPM press at SPE Exhibit early in 1946

An Interpretative Survey of German Plastics Fabrication

A miscellaneous assortment of articles typifying a number of German plastics fabrication methods

Part III. Unique processes were used in the manufacture of films and sheeting, and polyvinyl chloride paste techniques were far advanced

By W. C. Goggin
Manager, Plastics Development Division
The Dow Chemical Company

THE Germans used several unique processes for the manufacture of films and sheeting materials. These included (1) the production of *Styroflex* (polystyrene) by the extrusion and stretching of polystyrene extruded tube; (2) the production of polyvinyl chloride unilaterally stretched film known as *Luvitherm;* (3) solvent-casting on a belt for the production of polyamide and cellulose acetate sheeting; and (4) experimental processes for press-polishing acetate sheeting.

A large variety of calendered products was available. These included plasticized polyvinyl chloride in thin flexible sheets for raincoats and waterproof covers; heavier, stiffer compositions for shoe soles; and perforated sheet for battery spacers. Acrylate sheets for plastic glazing were made by a somewhat conventional casting method.

Since the process for producing oriented polystyrene *(Styroflex)* films was described in detail in the previous section on extrusion, further description is not necessary here.

The process for the production of *Luvitherm* (unilaterally stretched polyvinyl chloride) was one of the more recent German developments. It used unplasticized polyvinyl chloride of relatively high viscosity (the higher the better). The resin was first treated by ball milling under slight heat. During this operation .3% soda and diphenyl thio urea were added as stabilizer and 3 to 5% of a suitable wax as a lubricant. The powder was milled warm enough to melt the wax, heat being supplied directly on the ball mill by gas flames. The warm ball-milled powder was then worked on a 160°C (320°F) two-roll mill in 7 to 12 lb batches for 5 min. These mills were standard steel rolls 39″ by 17″.

The hot-milled resin was then hand-fed to the bottom roll of a three-roll *Luvitherm* calender. Temperatures were bottom 190°C (374°F), middle 185°C (365°F), and top 155°C (311°F). This calender had a trimming roll knife operating on the calendered sheet. The foil leaving the calender for the stretcher was 5 to 8 mm thick (2 to 3½ mils) and 50 to 55 cm wide (20″ to 22″). The top calender roll was equipped with radiant heaters and air cooling jets which could be directed on the roll surface to adjust local temperature conditions to the optimum. Roll speed was 10 meters per minute (33′).

From the calender, the sheet passed through mechanical electrical thickness gauges to the stretching stack. These thickness gauges, operating on either edge of the film, gave accurate indications of the unstretched film thickness at all times. Finger-tip control of electric motors quickly brought calender spacing and resulting film thickness back to standard when thickness trouble was encountered. The principal

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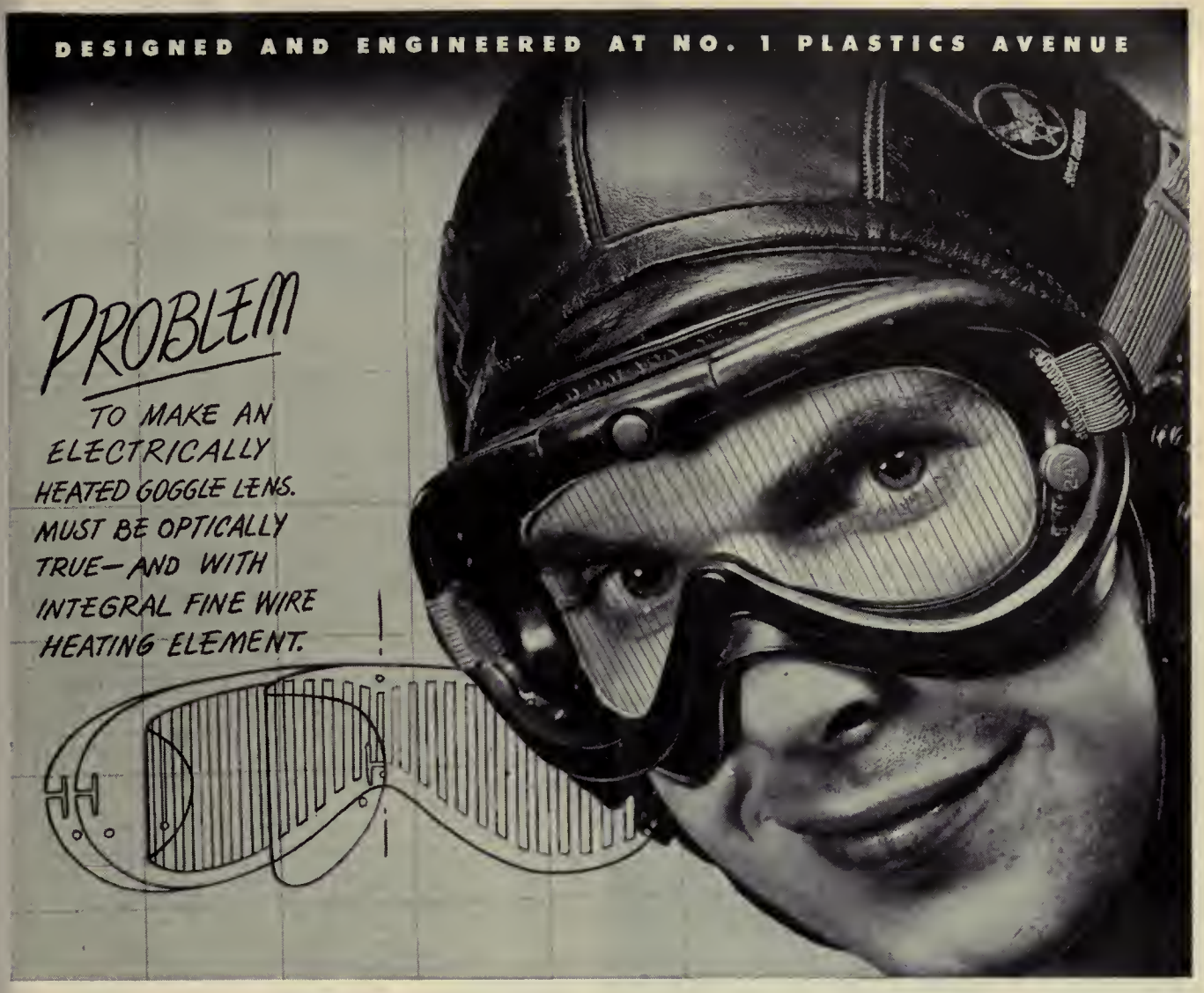

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elements of the stretching stack, aside from pinching and turning rolls, were set at an original feed speed of 8 meters per minute (26 fpm). These elements were as follows:

(1) A large drive, electrically-heated 24-inch diameter roll. Some stretching was involved. Speed was 10 meters per minute.

(2) Hard, rubber-driven pull-roll.

(3) Stationary aluminum 270°C (518°F) roll with spreader channels. Foil was drawn and received extensive stretching over this heated roll. The width of the film was reduced 10 to 15%.

(4) Stiff rubber pulling roll operating at 24 meters per minute.

(5) Alternate winding mechanism reeling the film on one side while the other reel was being removed and replaced.

The total length of the path through the stretcher was 23½'. Production rate was 15 to 20 kg per hr (33 to 44 lb per hr). The final thickness of the film was measured by an extremely accurate micrometer known as the *Ortho-test* and made by Zeiss. Present tolerances on .03 mm (1.2 mil) final sheet were ± .005 mm (± .0002 inches).

A "Luvitherm" film stretching machine in operation. Note heating cylinders—movable at top center, fixed in center

The types of film made were *UG–40,* unstretched polyvinyl chloride film .04 mm thick (1.6 mils) used for packaging, cartons, book bindings, laminating to paper; and *Type G–30* stretched film .03 mm thick (1.2 mils) used largely for wire and cable wrapping.

A new type, still experimental, was known as *Type 2G.* It was .015 mm thick (.6 mils), and was stretched in both directions. This was accomplished by first making standard *Luvitherm UG–40,* and in a second operation stretching it in the other direction. The machine for this operation consisted of a heated half-cylinder over which the film was drawn and stretched sidewise, by traveling in tenting grooves on disks set at an angle with the axis of the cylinder. The film was held in the groove by a continuous string running on top of the film.

Luvitherm film had been used experimentally in large-scale tests for cheese wrapping. When fabricated into containers using a vinyl acetate or chlorinated polyvinyl chloride adhesive, the system worked quite satisfactorily. The Milk Institute in Southern Germany expected to use *Luvitherm* at about the rate of 8 tons monthly for this purpose. The product was found to be successful for packaging butter and cheese, such as Camembert, by cutting the sheet and folding it to fit the shape of the cheese block. It was said, however, that in most cases aluminum foil would be equally satisfactory.

The casting of polyamide-type film known as *Lyafoi* was carried on quite extensively to produce military gas-resistant capes. The products used were polyamides based largely on the standard 6–6 type and caprolactam. A representative casting solution had the composition of 60 kg 6–6 type polyamide, 40 kg caprolactam, 300 liters of an ethanol 71%-water 29% solution. This is dissolved at 70 to 75°C (158 to 167°F) in a 1000-gallon, tin-lined, copper-jacketed agitated horizontal kettle, and fed through steam-traced lines to two 500-gallon jacketed kettles similarly lined. This solution was band-cast on a 30 meter copper or silvered-copper finished band turning over 6-foot drums. The rate was 160 to 200 meters per hr (525 to 660 ft per hr), and the trimmed width 115 cm (46"). Total capacity per machine was 100,000 square meters per month. Standard cast thickness was about .002 to .003". Casting temperature was 60°C (140°F). The regular film casting nozzle was used. Solvent was recovered in carbon absorbers. This film had good chemical resistance to expected poison war gases and was flexible to a temperature of —15 to —20°C (5 to —4°F). Water permeability proved a drawback to food packaging.

Experimental Machine

The production of cellulose acetate cast film was not large. It was understood, however, that some was produced by solvent-casting methods of the conventional type. Some sheeting was also produced by platen-type compression molding. An experimental press-polishing machine was being developed. The device was a continuous belt drawn over a heated drum. The film was laid on the belt and pressed under heat continuously as it traveled over the drum. Cooling was applied before the pressure was completely released. This was tried on a hard cellulose acetate sheet of approximately 25 mils thickness and a soft polyvinyl chloride sheet of approximately 15 mils thickness. It polished on one side only and appeared to be very slow. Plans called for replacing the belt with a stainless steel band so as to polish both sides with one pass. The problem of control of side motion of the stock through the machine had not yet been worked out.

The use of calendering equipment for the production of heavier flexible and rigid plastics sheeting was very extensive in Germany. A wide variety of calenders, largely

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Gloves, coated cloth, rolls, tubing, and other flexible polyvinyl chloride samples were made by paste techniques

3-roll types, was seen. The material used most commonly was polyvinyl chloride or its copolymers. A wide variety of compositions and thicknesses, ranging from 5 mils up to around 100 mils, was produced. The standard battery consisted of a Werner-Pfleiderer mixer (a ribbon mixer could be used) to stir the resin and plasticizer together cold. Two-roll rubber mills were then used to plasticate the material. This was followed by a standard three-roll calender. The stock from these calenders was used for raincoats, protective tarpaulins, mine conveyor belt covers, hospital sheeting, camouflage ribbon, and shoe sole material. A composition of 45% vinyl chloride, 10% organic filler, and 10% inorganic filler gave best results during the war for standard civilian soles. This was produced by a standard milling process followed by hot-pressing to emboss the finished sheet properly. The result was a relatively stiff, long-wearing sheet. The press cycle totaled 30 sec, 10 of which involved hot pressure. The sole was flexible to —25°C (—13°F). Personal road tests over standard courses gave it a life 50% greater than rubber and 200% greater than leather.

Acrylatic type sheeting was made in a somewhat conventional casting process. It involved polymerizing in glass cells loaded in a slant position and cured horizontally. The glass was cleaned with iron oxide, distilled water, and tin chloride. The cell was assembled from two glass sheets and a thin laminated phenolic spacer of very exact dimensions and good finish. The third important element was an adhesive paper which was tight to the monomer. The cell was built up from glass and the phenolic spacers. The edge was then papered outside with the type described above, and the spacers were pulled out through small openings. The cell was canted, carefully filled with methyl methacrylate with or without dibutyl phthalate as a plasticizer (up to 20%), and approximately .02% benzoyl peroxide catalyst. The cell was then polymerized horizontally in an oven where it passed through various heat zones. The heat must be reduced after the start of the reaction in order to avoid bubbles. For a 5 mm plate, a typical schedule was 5 hr at 55°C; 4, at 45°C; 2, at 50°C; 2, at 65°C; and finally 4, at 85°C, gradually increasing to 125°C. The total cycle usually ran 18 to 20 hr.

For airplane transparencies, the paper could be stripped about one-half way through the process when the conversion is around 22%. This eliminated "edge foot" and permitted removal of the glass plates without breaking. Meanwhile the plate could move as the polymerization progressed. This process had almost completely eliminated serious glass breakage and sheet loss.

Polyvinyl Chloride Pastes

The use of plasticizer-dispersed polyvinyl chloride paste had progressed far beyond similar developments in the United States. Briefly, the process was one of dispersing a finely-ground polyvinyl chloride in coal plasticizer. The material could then be handled as a thick paste-like product. The paste could be poured into molds, coated on cloth, or spread out as flat sheets. When the temperature of this paste was raised to the proper degree, the polyvinyl chloride became soluble in the plasticizer and the whole became a homogeneous, rubbery, gelatinous mass. This mass had good strength, flexibility, and ageing properties. Its behavior appeared to be almost identical with that of polyvinyl chloride which had been plasticized by milling-in the modifying agents. The product had been used extensively for the production of shoe soles, dipped goods such as gloves, and odd-shaped tubes, molded printing rolls, and a wide variety of coated fabrics.

The base resin used was probably the most important single consideration. The German designation for the correct polyvinyl chloride was PCU-P. Investigations revealed that the Germans did not have standard specifications on this product; that, further, it was difficult to establish any specifications that would accurately determine whether or not the polyvinyl chloride would make a satisfactory paste. The only method of establishing this point was to mix a sample with about 50% of a suitable plasticizer, subsequently heat it, and determine first whether it would make a good paste, and second whether it would make a good homogeneous, rubbery, plasticized polyvinyl chloride. Experience had shown, however, according to the Germans, that the best product had a particle size of about 1-3 microns. It should have a molecular weight of 200,000 to 270,000. Higher molecular weights appeared to be too insoluble, lower molecular weights too soluble. The product should have a high bulk density. Their experience showed further that about the only way production was possible was by emulsion-polymerization and subsequent spray-drying in a *Nubilosa* type dryer. To raise the bulk density of the product coming from this dryer, the temperature of the influent air or the pressure on the spraying nozzle would be lowered. The minimum plasticizer content had to be established for each batch of paste. For the best grades, this minimum appeared to be 35 to 40 parts of liquid plasticizer to 60 to 65 of polyvinyl chloride.

A typical plant made this paste in a light steel pony mixer, taking a 200-kg (445 lb) charge, comprising 100 parts PCU, 50 parts tricresyl phosphate, and 50 parts *Mesamoll* (mepasin sulfophemolate), mixing ½ hr at room temperature. Pastes made in this way were highly viscous dispersions with an estimated viscosity of about 1000 poises.

The Germans' claim that these shoe soles gave excellent wear life could not be disputed on the basis of any laboratory tests. The system they used for testing was very real indeed. It consisted of making old-age pensioners wear shoes with comparative soles and walk continuously around a course of a variety of surfaces designed to give relatively severe wear. The results obtained varied somewhat, but were approximately as follows: well-tanned leather—800 to 1200 kilometers (500 to 750 miles); Buna rubber soles—2000 to 2200 kilometers (1200 to 1300 miles); and soles from polyvinyl chloride pastes—around 3000 kilometers (1800 miles).

These shoe soles were largely used for civilian wear and only in a limited way for the Army. Army applications were for heavy insulated sole for airmen's boots, and for

(*Continued on page* 102)

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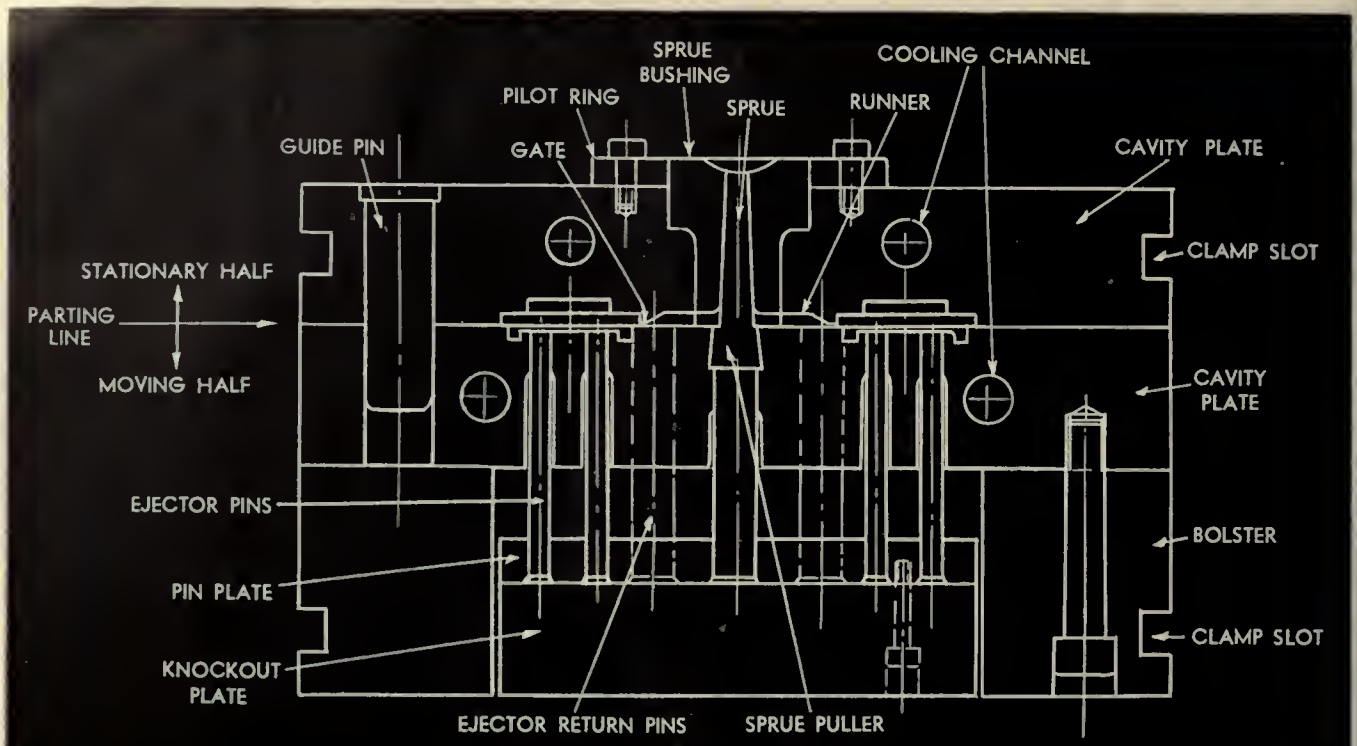

FIGURE 1 INJECTION MOLD WITH CAVITIES MACHINED IN THE MAIN PLATES

Injection Mold Design

Part II. A discussion of mold designing problems covering the cavities, type of construction, cavity layout, knockout plates

By John G. Robb

In its simplest form, the injection mold consists of two plates into which the mold cavities are machined (Fig. 1). In actual practice this solid construction is seldom used. Molding parts must be hardened, and therefore it would be impossible to assure perfect alignment between the cavity halves in a multi-cavity mold if they were machined into a large plate which was then hardened. All steel changes size and warps to a certain extent during heat treating, and the two halves of the mold may not change the same amount. Therefore, we should leave the plates soft, and set in the individual hardened cavities which can be properly aligned after hardening.

Cavities should be machined into the two main plates only on small molds of a few cavities where dimensional change on hardening would not amount to very much, or where piece design is such that an exact lineup of the cavities is not important. Under these conditions the solid construction will often result in a lower die cost. However, the repair or replacement of a damaged cavity is more difficult than in a mold using individual cavity inserts.

There are two types of built-up construction commonly used on injection molds. One consists of machining the individual cavities and punches in small blocks which are then bolted and doweled to the die shoe plates (Fig. 2). They are bolted on with the bolt heads away from the parting line of the mold so that they will not fill up with flash. The other method of construction consists of fitting the individual cavities into holes which have been machined into the cavity and punch retainer plates. This construction is illustrated in Fig. 3.

The former of these is usually the less expensive mold making job of the two. The individual sets of cavities and punches can be lined up and doweled together. They are then bolted and doweled to the main die shoe plates. After they are all doweled in place, a slot is milled between the two rows of cavities, and the top and bottom center bars are fitted in place and bolted. These center bars contain the sprue, sprue puller, and runners. This type of construction eliminates the work of machining the holes in the cavity and punch retainer plates and of carefully fitting the parts into the holes, but while it is cheaper it also is inferior in several ways. It does not give as quick and uniform cooling as can be obtained by the set-in construction. Often material will force its way down in between the cavities and the center bar, and force the cavities out of alignment. There is also a chance that the unsupported guide pins may spring out of line enough to cause bad alignment between the halves of the moldings. For these reasons the majority of the injection molds are built with the set-in type of construction.

If round cavity blocks are to be used, holes are bored in

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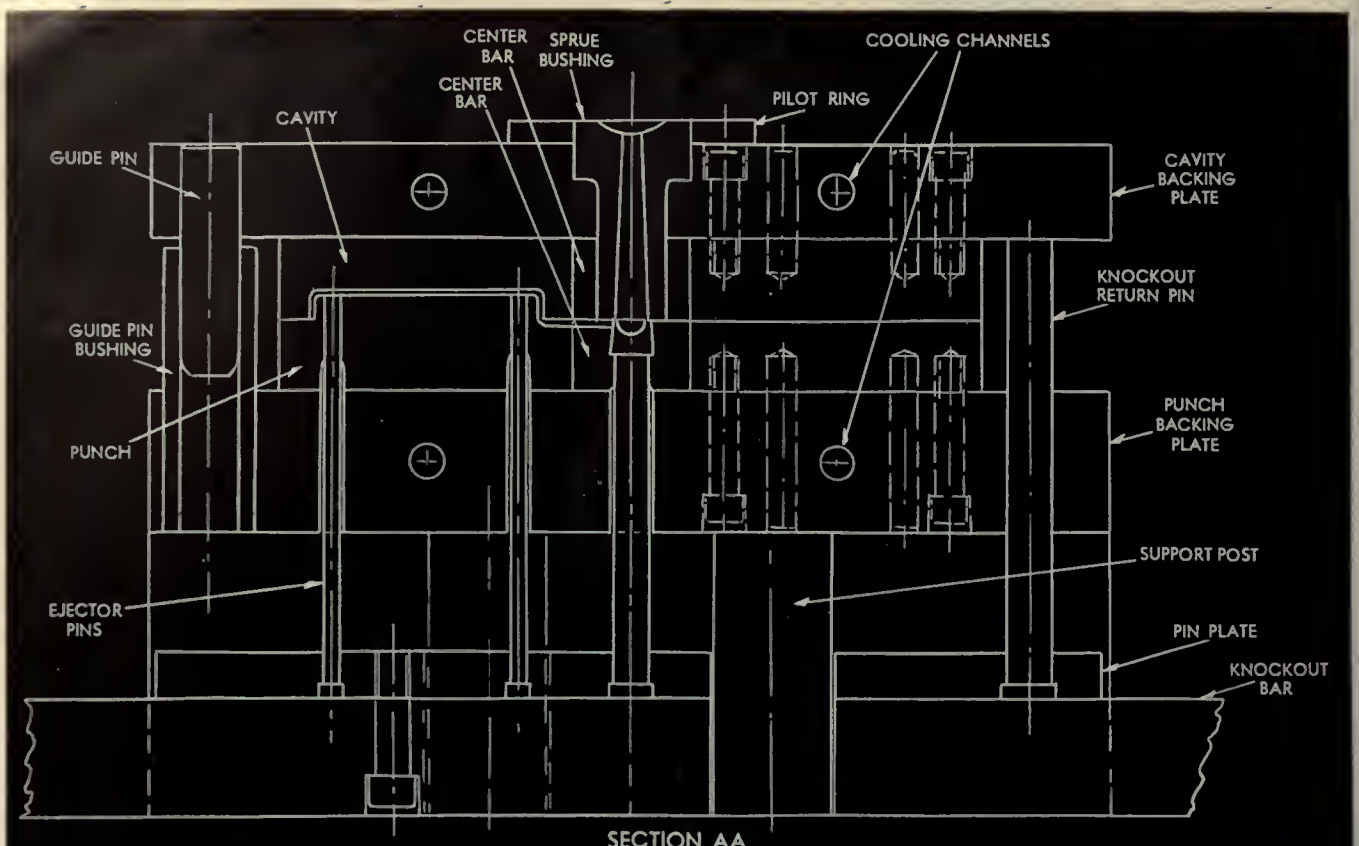
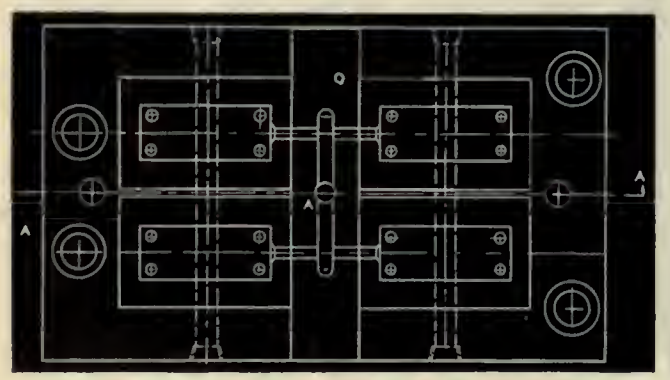
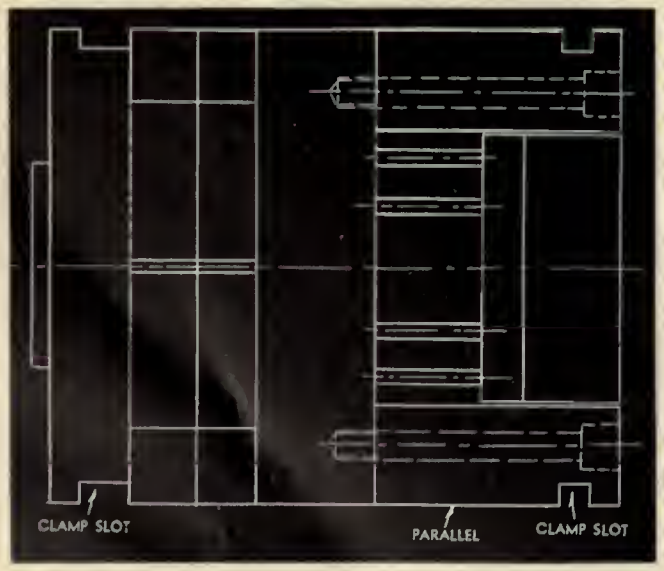


FIGURE 2 INJECTION MOLD SHOWING SET ON TYPE OF CONSTRUCTION



Plan view of set-on type above, side view below



the cavity and punch retainer plates while they are doweled together by the guide pins. The plates are then counterbored on the back side, and the cavity and punch blocks are fitted in, thus giving perfect alignment between cavity and punch. Dowels are then used at the circumference to prevent cavity and punch from rotating if piece design is such that this is necessary. The stream of material injected into the cavities often causes rotation if this precaution is not taken. If the cavity is of such a shape that a round cavity block is not suitable, and a square or rectangular block is to be used, a suitable hole is milled through the cavity and punch retainer plates, and the cavities and punches are set into the holes and held in place with screws from the base plates. Often one large window is milled through the two plates, and the individual cavities and punches are set in with a pair of center bars placed between the rows for the main runner.

Regardless of the type of construction, guide pins of ample size and quantity should be supplied to assure that the two halves of the die will remain in proper alignment. These pins—usually four in number, and from three quarters to one inch in diameter depending on the size of the die and the accuracy required in the line-up of the molded pieces—are hardened and ground. Standard pins can often be purchased cheaper than they can be made unless the shop is large and well equipped.

These pins are a press fit in one half of the mold and a slide fit in the other. If the plate into which the pin is to slide is left soft, a hardened bushing will be inserted in the plate for the guide pin to run in. Unless there is some reason for doing otherwise, it is considered good practice to press the pins in the injection half of the mold so that they will not be in the operator's way when he reaches into the open mold to remove the casting from the ejector half. Of course on stripper plate molds the pins have to be pressed into the moving half of the mold as the stripper

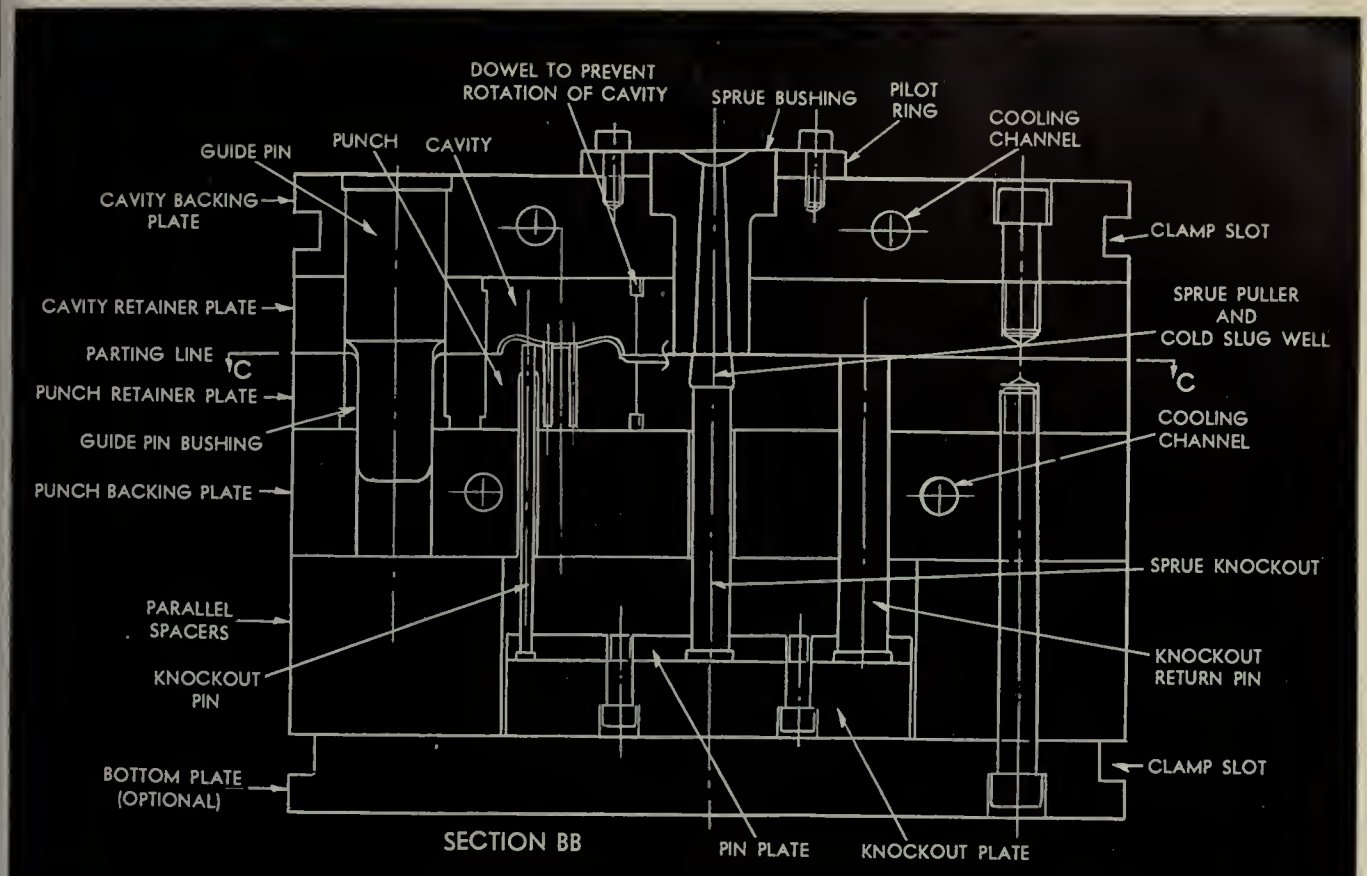


FIGURE 3 8-CAVITY INJECTION MOLD FOR PHONE CAP SHOWING SET IN TYPE OF DESIGN

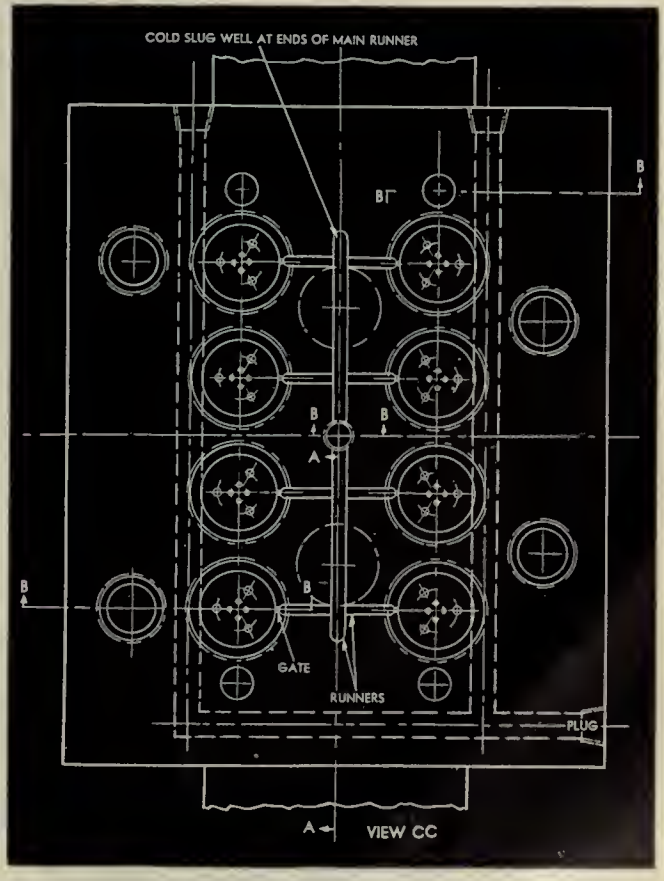
plate slides on them as it moves forward to eject the pieces. If there are long punches extending above the parting line on one half of the die, it is well to have the pins pressed into that half so that they will help protect these punches from damage when the mold is open on the bench, or is being put into the machine. In this case the pins should be long enough to extend beyond the punches.

Requirements for Knockout Plate

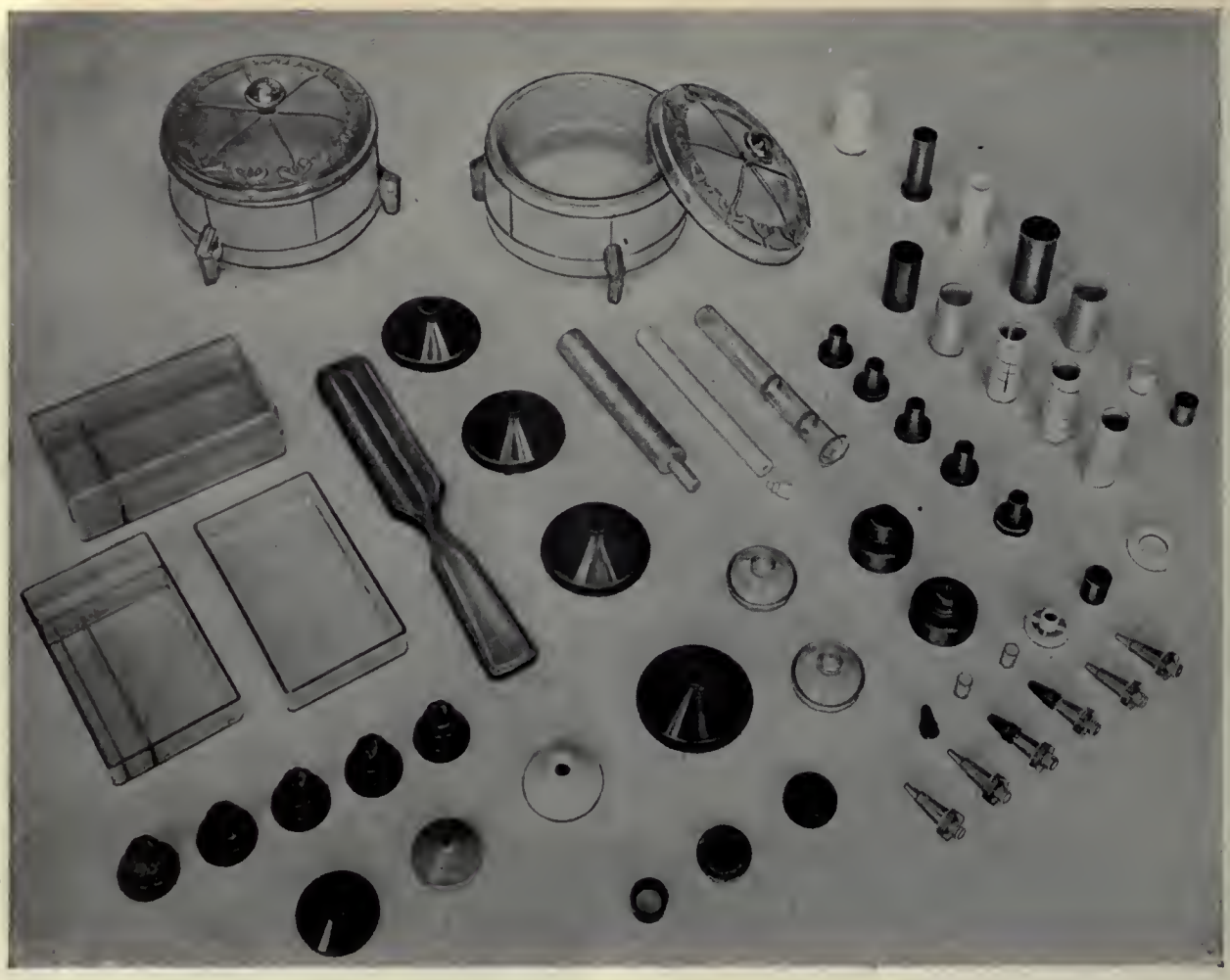
Under the moving die plate there is an open space to allow for the motion of the knockout plate. If this area is too wide and is unsupported in the center, the pressure of the incoming material will spring the die plates, causing the mold to flash and give reject castings. Therefore it is necessary to be certain that sufficient support be furnished in this area. The knockout plate should be as narrow as possible, and in addition it is often advisable to supply posts near the center of the die which go through holes in the knockout plate and back on the platen or bottom plate. Care should be taken not to put in too large posts and thereby weaken the stripper plate unduly.

Most injection dies are made with a bottom plate behind the knockout plate, but this is often an unnecessary refinement. If the platen on the machine is kept flat, there is no need for this bottom plate unless the die is designed for ejector sleeves. Omission of this back plate results in a saving in the cost of the die. Also, the die can be fitted into the machine more easily in many cases if it is swung into position between the tie bars without the knockout plate in place. This is especially helpful on machines which require a long knockout plate to meet the stops on the machine. Here the heavy die could not be lowered in from

(*Continued on page* 108)



Plan view showing the set-in type of design



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Drawings by Julian Krupa, *plastics* Art Staff

A Presentation of the Potential Applications of Plastics as Visualized by Industrial Designers

(*plastics* welcomes designers' contributions to this department)

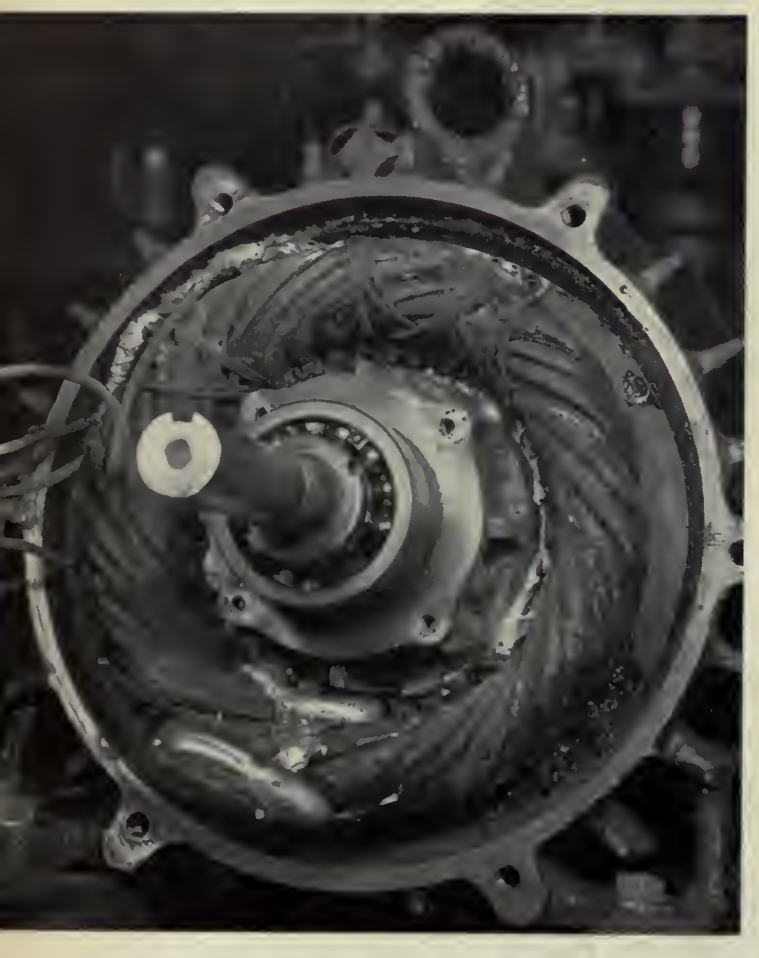
Refreshing departure from the conventional or stereotyped in radio cabinet design is evidenced in these two unusual designs by Henry P. Glass, Chicago. Both are compression molded of thermosetting plastics, each embodying compact convenience without detracting from functional qualities. Placement of dial control and volume knobs is factor in streamlined effect harmonizing with today's trends. Cone shape of model at right presents finished appearance from all sides and facilitates molding of louvres without coring or undercuts

Hans P. Nelson, Park Ridge, Ill., has designed these unique rattles to be formed of clear, transparent plastics. Planned to interest the child of toddler age in letters of the alphabet, the "book" rattle may have a slit at one end, enabling the child to shake out and to re-insert the letters, which can be of colored plastics or of plastics-impregnated cardboard. For the younger child, bright red plastics "musical notes" produce an intriguing "click" sound when drum-shaped rattle is shaken

Silicone Resins Aid High Temperature Insulation

Less weight, operation in high temperatures and longer service life is possible with new varnish

By R. F. Horrell
Design Engr., Motor Engr. Dept.
Westinghouse Electric Corporation



Bearing failure, not insulation deterioration, ended 3376-hour test of motor operating at 250° C hot-spot temperature

Silicone-insulated motor (left) produces 10 hp at 1750 rpm, same as the larger motor with Class A insulation

APPLYING silicone resins to insulating materials makes possible a weight reduction of 50% in certain general purpose industrial motors. These resins, when used in combination with inorganic insulating substances such as mica, asbestos, and *Fiberglas,* produce materials which have a higher thermal endurance than the conventional materials in use today, which are restricted by temperature limits set by the American Institute of Electrical Engineers Standards No. 1. These temperatures are based on the thermal endurance of the conventional materials, and such endurance becomes the primary basis for establishing general machine ratings. Therefore, any development which greatly improves the thermal endurance of insulation is of real importance to the user of industrial motor equipment. However, there are frequently other design considerations which outweigh thermal endurance, so that on some equipment little advantage can be gained. Each application must, therefore, be analyzed carefully by the design engineer.

Silicone is a generic name applied to a considerable group of compounds which link the organic and inorganic materials. Several of these silicone compounds are resins resembling organic varnish resins in their physical characteristics. The molecule of the silicone resins contains a silicon-oxygen chain, so that they have tremendously greater thermal endurance than the best of the conventional organic resins. Many combinations of molecular structures are possible with these silicone materials, and they may serve numerous purposes. For example, they are used as insulating varnishes, insulating resins, lubricating greases, filling compounds and fluids for various applications.

Silicone varnishes are available in forms similar to those with which the industrial motor user is familiar. Some silicone varnishes are made with organic solvents; others are of the solventless type. They are used to impregnate and dip-coat coils, insulation, and wound equipment by processes similar to those in which organic varnishes are used. Silicone varnishes normally require higher baking temperatures than organic materials, usually 225° to 275° C. For this reason, it is essential that a very minimum of organic material be contained in the insulation at the time of the high temperature bake. Therefore, organic resins must not be used in the manufacture of composite insulation to be used in conjunction with silicone varnishes.

If the design engineer is to attain the maximum utility of the thermal endurance of the silicone resins, both surface and sub-surface insulation must be thermally stable and

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Resistance comparison of silicone and organic varnishes at 235° C: Class A insulation 200 hr; Class B 2750 hr; HTS 5000 hr

moisture-proof. A complete line of insulating materials incorporating silicone resins with various inorganic base substances such as mica, glass, and asbestos has been developed, with limited availability. These materials are available in the same forms as the more familiar Class B materials.

Small induction motor stators have been wound with silicone bonded glass-mica slot cells; with silicone varnished glass-covered wire for the coils; and with silicone bonded glass-mica phase insulation. The completed stator was then vacuum impregnated in the high-temperature silicone varnish to furnish waterproof external coating.

Used on Coils

The field coils of small direct current motors have been wound with glass covered silicone treated wire and given a vacuum impregnation and two dips before being placed on the pole pieces. These same materials were used in the armatures, but baking temperatures were lowered to 200° C because the solders now available are likely to flow at 250° C. Still other silicone materials have been used in larger machines where pre-insulated and formed coils are used. For example, silicone bonded glass-mica tape has been used for ground insulation; silicone sized glass tape, for the outer protective wrapping; coils have been impregnated with silicone varnish; and the completed armature or field given a final dip and bake in silicone varnish.

The superiority of silicone varnished glass cloth as compared with a Standard Class B varnished cloth after twenty-four hours at 250° C has been demonstrated. The silicone treated cloth retains its original flexibility, whereas the Class B material is severely darkened and embrittled besides losing its desirable electrical properties after only two hours. The panels in an accompanying photograph illustrate aging characteristics of silicone and a high grade organic varnish. Samples A and B are unaged panels coated with silicone and an organic varnish respectively. Samples C and D are the same materials after aging two-and-one-half hours at 250° C. These samples were tested in accordance with the American Society of Testing Materials heat endurance test procedure which specifies bending the panels around a one-eighth inch mandrel through 180°. Sample E is silicone varnish aged at 250° C for 200 hr and subjected to the same test. While not illustrated, some types of the silicone resin have withstood this test after aging more than 1000 hr at 250° C.

Further measurement of the behavior of silicone films on aging is shown in accompanying curve. Percent elongation to mandrel failure of 2 mil films has been plotted versus the aging time at 275°, 250°, 225° and 200° C. For comparison, a curve is shown for 2 mil films of an organic varnish used in Class B equipment aged at 200° C. From these data it has been found that in the range from 200° C the silicone resins rather closely follow the "Ten Degree Rule"—that is that the life of the resin doubles for each 10° C drop in temperature.

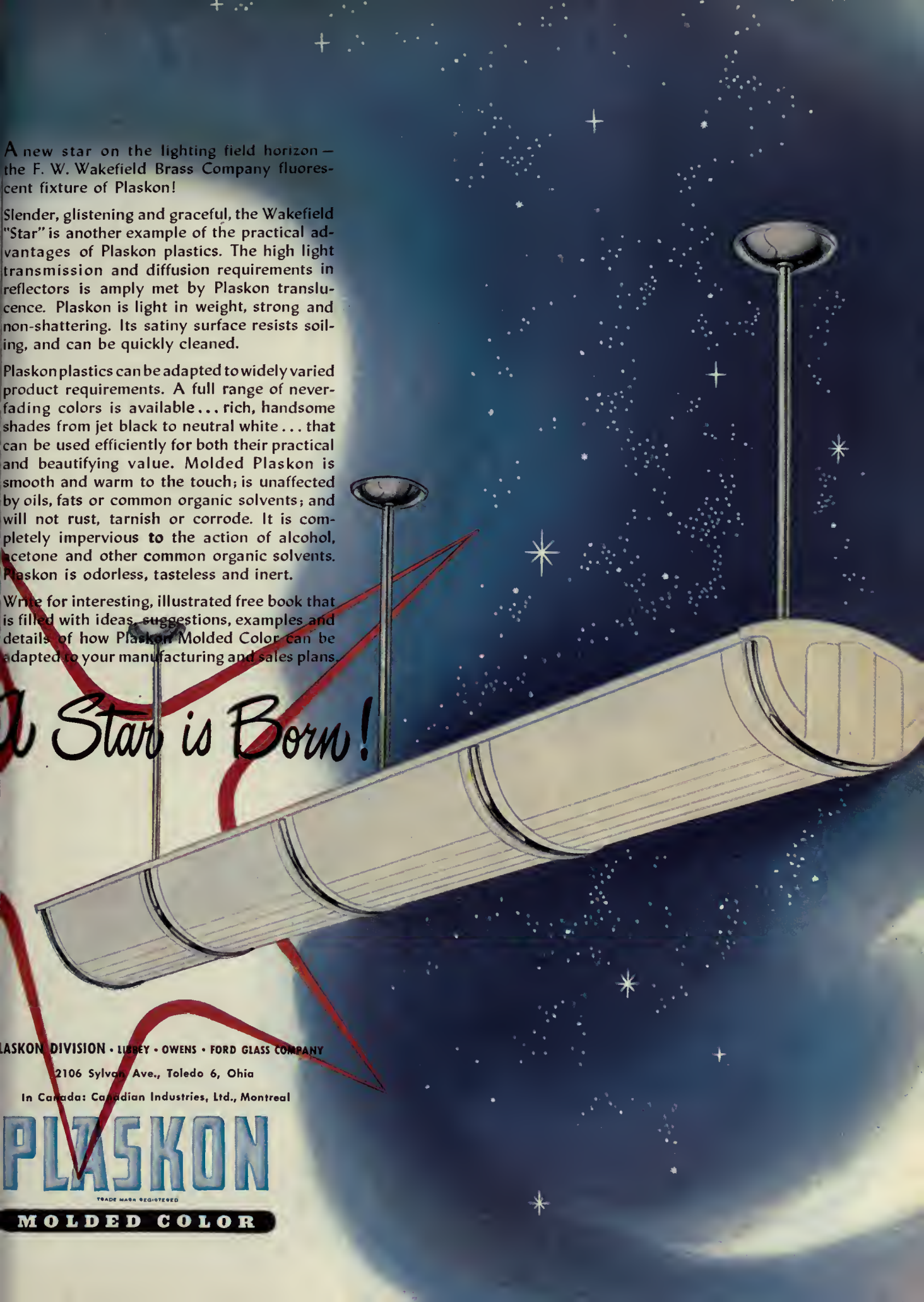
Silicone insulating materials offer somewhat more resistance to moisture than the conventional materials which use organic varnishes. Stripped films were used in the test for determining moisture permeability by clamping them as membranes over the open mouth of Payne permeability cups and measuring the weight loss under a controlled temperature and in a dry atmosphere. Data obtained show that no more water seeps through the unaged films than through the better waterproofing insulating varnishes or soft vulcanized rubber. After aging for thirty days at 200° C the silicone film has shown a consistent trend toward improvement, whereas organic films cannot be depended upon as they may or may not improve. Tests on complete equipment confirm these findings. On equipment given moisture and thermal cycling tests, the resistance to moisture has improved with time.

Excellent Water Repellents

Some low viscosity silicone fluids of the lubricant type make excellent water repellents. These fluids prevent water from forming a continuous film on a surface treated therewith. It has even been suggested that paper raincoats could be made; and fishermen regard the fluid as excellent for floating dry flies in fast water.

One very interesting vibration and thermal cycling test was conducted on a group of silicone-insulated and Class B insulated coils. Various methods of insulating were incorporated. Coils tested used such materials as mica tape, glass and asbestos wire covering with various types of mica wrapper, and glass and asbestos finishing tape. One of the groups of coils was made up of silicone treated glass covered wire, silicone bonded glass and mica wrapper, and silicone sized tape with silicone treatment applied to the completed coil. These various coils were placed in a 28-inch diameter d-c motor armature with a 28-inch core length for convenience only. The armature remained static and was vibrated by external means. Severe thermal cycling was obtained by supplying 750 amperes, 420 volts, a-c, 72 times per minute. This load was intermittent and was held for

(*Continued on page* 55)



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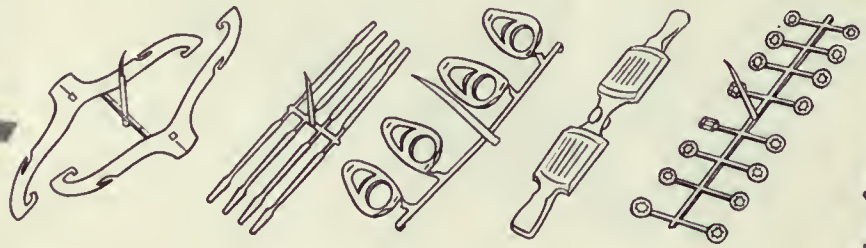

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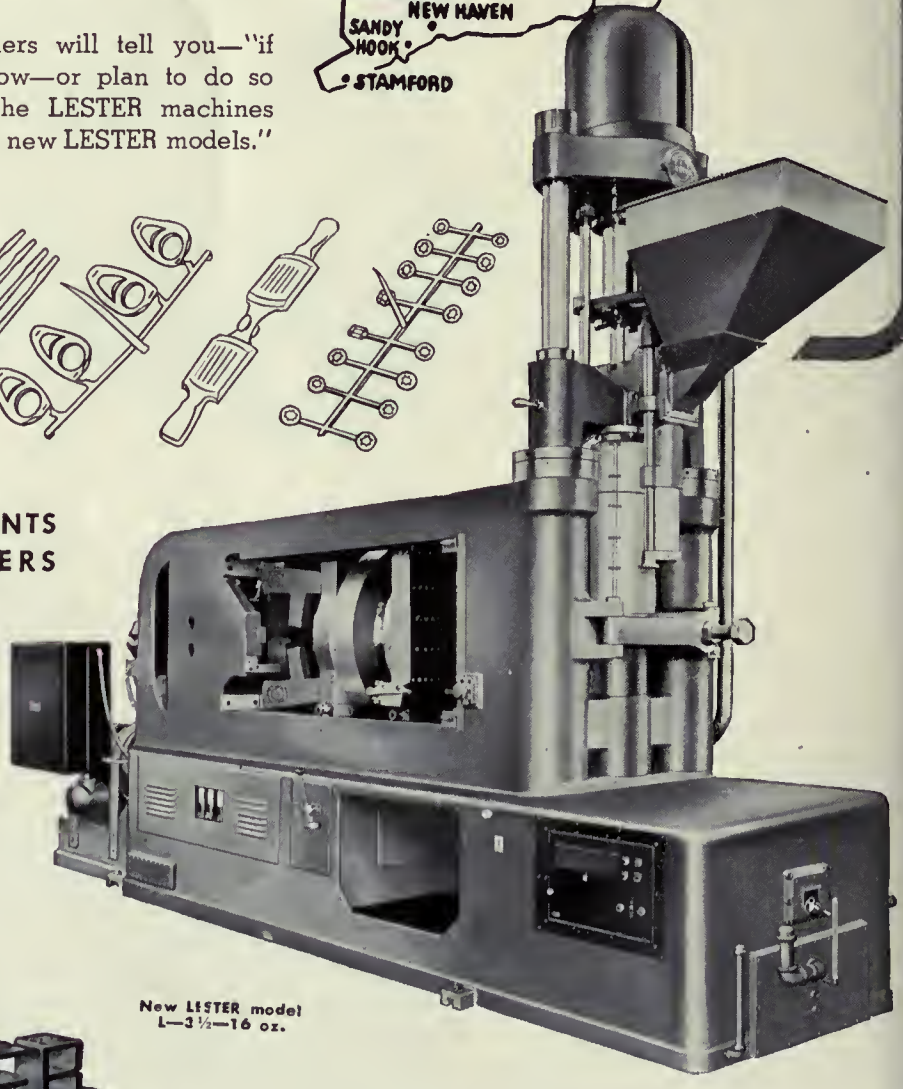

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Failure Time (Hours) of Silicone Insulation

Aging Temperature (°C)	Elongation of Test Sample (%) 14.4	7.2	3.6	1.8	Craze Failure Time
250	36	55	63	80	85
225*	225	290	375	500	590
225**	205	314	360	456	485
200*	1060	1630	---	---	---
200**	1160	1790	---	---	---

* Actual ** Calculated by 10-degree Rule.

three seconds duration. During this test, temperatures in the order of 230° C were observed. The tests covered 16 hr per day for a period of 36 days. Examination of the test coils revealed that while some of the Class B insulated coils had not failed, they showed signs of thermal aging and embrittlement of the resins. The silicone coils not only withstood the test satisfactorily, but the insulation was still in excellent condition.

In order that the life of the silicone insulation be at least equivalent to that now obtained with Class B insulation, it is suggested that the limit for the permissible observable temperature by resistance be set 40° C above the present Class B limits. This general rule is offered because certain types of equipment have special temperature limits for Class B insulation. It is proposed that the general limit corresponding to A.I.E.E. Standards No. 1 be 175° C for hot spot temperature. This includes a 5°C increase in the allowable difference between the observed value and the hot spot temperature.

There are three important ways in which improved thermal endurance properties may be utilized by design and application engineers in the industrial field. They are: (1) a reduction in size and weight of electrical equipment is possible where the operating temperature can be increased and where no reduction in insulation life can be tolerated; (2) increased service-life of the insulation can be obtained where it is desirable to maintain conventional size, weight, and temperature limits; and (3) operation in ambient temperatures above the permissible limits for conventional types of insulation can be maintained.

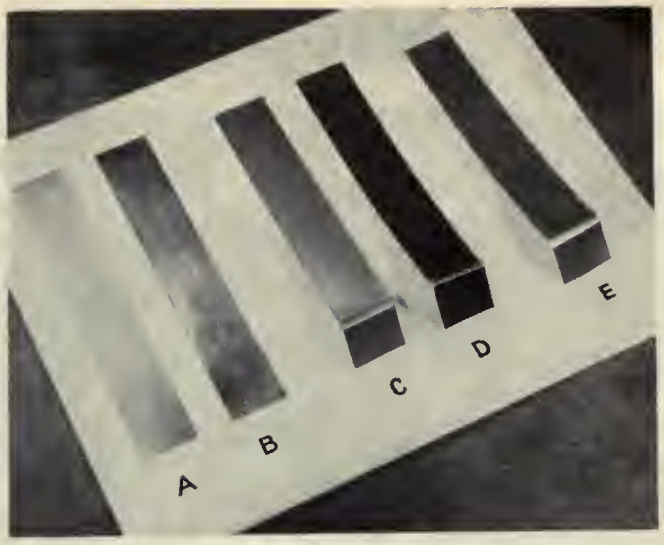
All of the applications to which silicone resins and composite insulation have been introduced are beyond the scope of this article. However, here are a few typical examples of their use in various equipment at the present time:

(1) Totally-enclosed fan-cooled induction motors.

(a) Early in 1942 a totally-enclosed fan-cooled induction motor stator was wound for 10 hp using the best available Class B insulating materials. This stator was given a vacuum impregnation and two dips in silicone resin varnish. The motor was normally rated 3 hp with Class A insulation and 5 hp with Class B. A series of engineering tests, including overload temperature runs, was made. The overload runs included a 13-hour test at 300° C total operating temperature, and a peak overload test during which 500° C total temperature on the winding was observed by thermocouple. These tests were followed by an accelerated life test on the insulation during which the motor winding was operated at 210° C rise by resistance (250° C hot-spot temperature) for 3376 hr. The motor was dismantled and examined periodically. The winding was also subjected to a high humidity test. The test was terminated by a bearing failure which resulted in damage to the winding. An accompanying photograph shows the failure that resulted in molten aluminum running over the winding with little damage of the winding.

(b) A second motor was rated 25 hp at 1750 rpm and was built in a 15 hp frame. The motor was insulated as in (a) above. This motor ran for over 3200 hrs at 250° C hot spot before a mechanical failure of the bearing stopped the test.

(c) A third motor was built the same as (a) above except



Comparison of silicone and high grade organic varnish shows new varnish in good condition, organic damaged

that silicone materials were used throughout. This motor is still driving an M-G set after completing over 4100 hrs at 185° C hot-spot temperature. The set is shut down frequently so that in all respects the motor receives actual service.

(d) Another example is a 7½ hp motor which drives a caustic pump in a moist atmosphere. This motor operates 24 hr a day and is started once a week. It has been in service for over eleven months as against only a little over five months for a Class A insulated motor.

(e) A fifth motor, rated 25 hp, drives an evaporator pump in a wet location. This motor has been in operation for over thirteen months, whereas previous conventionally insulated motors failed in approximately six months.

(2) One 250 kva, 440 volt generator was made with silicone insulation throughout the stator. As a preliminary temperature test, the stator was short-circuited at 275% normal current. This load resulted in an observed temperature of 355° C, which was held for six hours. Subsequently, the stator was redipped and baked and then subjected to an accelerated thermal aging test. The test consisted of heating the stator on alternate days by loading the unit as a generator. The observed rise by resistance was 210° C (250° C hot spot). At the end of 2966 hr the test was terminated

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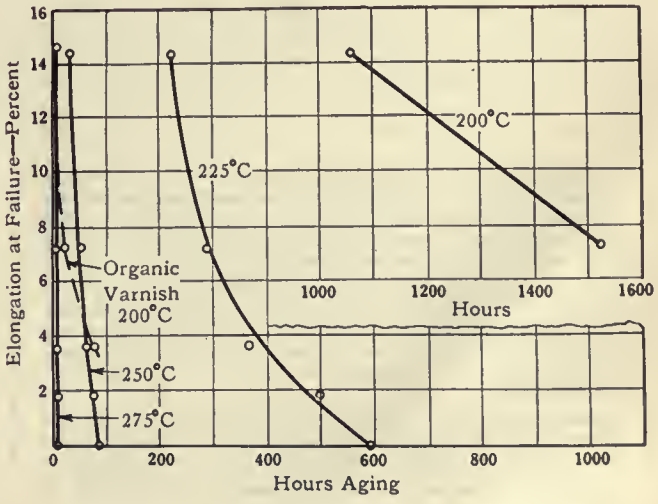

Silicone and organic varnish film elongation comparisons

Report on the SPI Annual

Over 1500 persons gathered at the Commodore for the Annual Banquet, a high spot in the program of 1946 Annual Conference

OVERSHADOWED perhaps by the glamor of the Exposition but not conceding an inch to it in importance, the SPI Annual Conference was held from April 23 to 25 at the Commodore Hotel in New York City. While the actual sessions did not begin until the 23rd, registration opened on the 21st, and the Pioneers Luncheon, an annual affair, was held on the 22nd. The following two days were the big days of the technical program, after which the Conference tapered to a close on Thursday morning, April 25, with two papers and a committee meeting.

The schedule was so arranged that in the mornings specialized papers were presented before the various divisions of the SPI, and in the afternoons less-technical papers were given at the general sessions. Only one evening was taken up by Conference activities, that of April 24, the program including a reception in honor of the Hyatt Award winners, the Annual Banquet, the Hyatt Award presentation, an address by Dr. Preston Bradley, and a concert by Fred Waring and his Pennsylvanians.

Approximately 200 exhibitors displaying thousands of plastics products running the gamut from standard moldings to brand new items appearing in public for the first time drew some 83,000 spectators to the Grand Central Palace in New York City from April 22 to 27 for the first SPI-sponsored National Plastics Exposition.

At the eminently successful show, spectators saw new machines, new processes, and a myriad of colorful and attractive end products ranging all the way from washable wallpaper to a laminated clown smoking a laminated cigar, from delicate costume jewelry to impact-resistant boats, and from toy bugles to real mandolins.

Machines on the floor ranged from a toy injection press for molding miniature charms to presses weighing in the tons, the busy hum of which never failed to lure a mass of spectators.

The industry is elated at the unqualified success of the Show.

At the Banquet, attended by over 1500 members and guests of the SPI, Dr. Edward R. Weidlein, Director of the Mellon Institute of Research, announced Virgil E. Meharg, superintendent of develpment, Bakelite Corp., Bound Brook, N. J., and Paul D. Zottu, consulting electronics engineer, Newtown, Mass., as the winners of the John Wesley Hyatt Award for 1945, and presented each with $500 and a gold medal.

The recipients were selected for their work in the electronic heating of thermosetting plastics, which was conducted separately and simultaneously by the two men. Their efforts resulted in speeding up the curing time of molded and laminated plastics and, it was said at the presentation, contributed much toward winning the war.

The Hyatt Award, sponsored by Hercules Powder Company, has been presented annually since 1942 for outstanding achievement in the plastics industry during the preceding calendar year.

Another significant event was the announcement of officers for June 1946-June 1947. Save for five new directors, all officers and members of the board were re-elected. The principal administrative officers chosen to carry on another year include: George K. Scribner, Boonton Molding Co., as Director and Chairman of the Board; Neil O. Broderson, Rochester Button Co., as Director and President; George H. Clark, Formica In-

Conference

Pioneers luncheon, election of new officers, technical papers, talk on materials supply, annual banquet highlight 3-day session

Paul D. Zottu and Virgil Meharg, John Wesley Hyatt Award winners, are presented their medals by Dr. E. R. Weidlein

sulation Co., as Director and Vice-President; and Warren E. Hill, Prolon Plastics Division, Pro-phy-lac-tic Brush Co., as Secretary-Treasurer.

Of the other eleven directors, the following six were re-elected: Gordon Brown, Bakelite Corp.; Charles F. Elmes, Elmes Engineering Works; Donald L. Gibb, Dow Chemical Co.; Herman B. Lermer, Celluplastic Corp.; W. H. Milton, Jr., General Electric Co.; and Paul C. Tietz, Richardson Co.

E. L. Anderson, Globe Tool & Molded Products Co.; Norman Anderson, General Molded Products, Inc.; John D. Benedito, Canadian Resins & Chemicals, Ltd.; Robert A. Cooper, Plastic Die & Tool Corp.; and N. J. Rakas, Chrysler Corp., were the five new members chosen.

Technical Sessions Begin

The technical sessions got under way on April 23 with group meetings of the Button Division, Compression Molders, and Extruders; a luncheon session, including greetings from the British plastics industry by Dr. W. J. Worboys, Vice-Chairman of the British Plastics Federation, and a talk on the development of the atomic bomb by Major General Leslie R. Groves; the annual business meeting, including reports from the following committees and individuals: Technical Committee, N. J. Rakas; Educational Committee, Horton Spitzer; Accounting Committee, R. S. Oliver; Public Relations Committee, John Sasso; and William T. Cruse, Executive Vice-President; and, finally, a talk of major importance on the materials supply situation.

This program was followed the next day by group meetings of the Injection Molders, Machinery Division, Fabricating Division, and Low-Pressure Industries Division in the morning; talks in the afternoon on the heat-sealing of thermoplastics with high-frequency energy, the PMMA-sponsored Massachusetts Institute of Technology research project, the status of plastics in South America, and low-pressure molding; and the evening program already discussed.

Divisional officers elected during the Conference were Horace Gooch, Worcester Moulded Plastics, as chairman of the Injection Molding Division, and John E. Stokes, Bakelite Corp., as chairman of the Low-Pressure Industries Division. T. Walter Noble, Fabricon Products, Inc., and Robert Brinkema of Egmont Arens were named as vice-chairmen to Stokes.

Lack of space permits only brief treatment of the many excellent technical papers presented at the Conference. However, many of them are scheduled for fuller publicity in these pages and elsewhere. The treatments which follow take the form of abstracts, summaries, excerpts, or a combination of these methods of condensation.

Otto Boschen, Bailey, Green & Elger, "What the Import Market Will Mean to American Manufacturers" and "Button Styling": The American button industry has nothing to fear from a revived European manufacture because the latter has always produced novelty items in minor volume compared to our mass production. On the contrary, there would undoubtedly be a large market for American buttons in Europe today, particularly in England and Sweden, if the financial restrictions there did not prevent such sales.

Discussing "Button Styling," Mr. Boschen said that the essence of styling was in the word "simple," by which he did not mean "plain." A sample button can be both smart and decorative, he declared. The second important factor in styling is perfection of finish. He said: "The holes must be properly drilled, the colors clear, each detail perfect."

H. M. Quackenbos, Jr., Bakelite Corp., "The Impact and Flexural Tests for Molded Plastics; Their Relation and How to Use Them": Pointing out that one material may be stronger than another in flexural and impact tests yet weaker in the molded object and that the impact test is the more unreliable of the two, Quackenbos said that in conventional Izod impact strength tests, the energy absorbed by the specimen is only 10% of the total energy actually measured.

"The load-deflection curve for most common phenolic materials," he said, "is exactly the same whether the loading is impact or gradual as in a flexural test. . . . And so we can replace the false and misleading Izod impact test with a slow test on the same kind of bar. Or for convenience we can switch over to an ordinary flexural test except that the bar is notched. . . . The energy under the load-deflection diagram for a notched bar is then true impact energy. This is expressed in foot-pounds and we will call it flexural work to break."

In summary Mr. Quackenbos said: "At present the flexural and Izod impact tests are not applied with confidence because their predictions are often reversed by field experience; a material rated good by the flexural test may be poor by the Izod test and vice versa. One trouble with the Izod test is that it is poorly carried out. When properly analyzed it is akin to the flexural test, and impact resistance is truly expressed by flexural work to break. But flexural work to break and flexural strength are no good as such. The secret of applying them successfully lies in the notch effect. The practi-

(*Continued on page* 94)

Boiling water test leaves melamine bowl at left lusterless and chalky. Other, properly molded, is unharmed

Testing the End Product

Standard test results aid choice of materials, but simulated usage better evaluates product performance

By H. R. Sjostedt

Chief Chemist, The Watertown Manufacturing Company

The shadowgraph, a highly useful instrument, is here being used for checking the concentricity of a small piece

DATA obtained by means of standard tests on pieces of a certain size molded at stipulated temperatures and pressures are invaluable in choosing a plastics for a given application, but the only way to determine the suitability of a manufactured product is to test it under conditions as closely as possible simulating those it will encounter in actual use.

If you study a data sheet of the properties of any particular plastics, you may see values which would be very desirable in the product you plan. But it is important to remember that it is not likely that you will obtain those values completely in the finished product. Since an actual product has different dimensions and is usually molded under different conditions, the result is that it does not have the "book values" of the properties of the various molding compounds, and it naturally follows that products must be tested themselves if they are to have the properties the molder wishes them to have.

This is not to disparage standard tests and their results, for they are the only reliable guide we have for a *comparison* of the properties of the many members of the plastics family. Also, in trying to choose one of two or more plastics for use in making a given product, it can be assumed that, though the values in the product will probably not measure up to the values of the standard test pieces, they are likely to be in the same ratio. For example, if the tensile strength ratio of Plastics A and B, shown by tests of standard test pieces, is 4 to 3, the same ratio is likely to hold true for the tensile strengths of identical products made from the two plastics.

Since the ultimate test of a molded piece is its end-use performance, however, it behooves the molder to devise tests

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Dexter, Michigan

Porosity in a molded article will give results varying widely from those of standard tests on a standard piece

which duplicate or approximate the conditions of actual use. In our laboratories we constantly check our molded tableware for water absorption, staining from coffee, and impact strength. Besides giving us data on the performance of the finished products, such tests enable us to choose the molding material best suited to our use. We have chosen in favor of melamines rather than the ureas because we have found the melamines much more water resistant, much harder, and more resistant to staining.

At Watertown we have had several cases where electrical testing had to be done on the finished piece, though the calculated dielectric strength as indicated by standard test data was far above the commercial requirements for the parts. In one case particularly, the part was transfer molded, and the molding material was injected into a metal sleeve. In the process of molding, voids were left between the plastics and the outside sleeve. Also the flowing plastics picked up metal from the plated insert, so that the pieces had to be tested individually for dielectric strength. X-ray pictures of the molded part were extremely helpful, for they showed the existing voids.

Strength tests, likewise, must be performed to ascertain the suitability of the final article. There are at present two types of specimens used to obtain standard values for tensile strength: the "dogbone," which is 4¼" in length, with the reduced section 0.250" thick; and a specimen 8½" long which can be ⅛" thick. The data obtained from these two types of specimens vary. Usually, the 8½" specimen is somewhat higher in strength. The results obtained, even on the testing of standard test pieces, are greatly influenced by the history of the specimens. Even slight scratches can alter the results considerably. Thus it is obvious that in commercial applications the expressed data sheet figure cannot be used, for besides the technique in molding and the difference in shape, the presence of inserts or machine scratches will change the results unfavorably.

In testing impact strength, either the Izod or Charpy method is usually employed. In either test, the value is determined by a single blow on a standard piece. It is a purely relative test and is greatly influenced by the history of the sample. In the Izod test, the specific gravity of the material and the size and shape of the notch that is milled in the piece have a considerable bearing on the final results. There is another machine, the *Dynastat* machine, requiring very small pieces, ½" by ¼" by 1/6", which are usually cut from a commercially molded piece. Thus in a sense it does give the impact strength of a final commercial molding.

These are all single blow determinations, however, and give little or no indication of the effect of repeated impact at lower than ultimate breaking strength—as, for example in the case of a bumper shoe used in automobile doors where the constant closing of the door would be acting on these phenolic parts. We therefore devised a test to simulate use conditions, as follows: a constant weight was dropped from a given height onto the bumper shoe positioned in a metal jig. These blows were repeated at a constant rate and, by correlation with actual performance, the number of blows that the shoe must withstand was obtained as a criterion for testing.

What has been said for impact and tensile specimens, in sofar as history and shape are concerned, applies also to the flexural specimen. However, the flexural strength can give more information suitable for calculation of the performance of a commercial molded article than the other two. This is especially true of phenolics because stress-strain relationship can be more easily obtained for phenolics or other thermosetting compounds than the other tests, such as tensile and impact strength.

Heat resistance is another characteristic of a molded article that can be vitally important in some commercial applications. The best way to test the resistance of a molded article to boiling water is to immerse it and see what happens. The shape, and especially the thickness, are important considerations, for as a rule a thin piece can withstand a higher temperature than a thick piece.

The rate at which heat can safely be applied in the final product is also a function of the heat resistance. This physical characteristic is of prime importance for handles or knobs on cooking equipment. Here at Watertown, these parts are tested under actual conditions for sufficient time to assure proper performance.

If the molded article is alternately subjected to humid and dry conditions, an entirely different result may be obtained than if subjected to either a consistently humid or consistently dry atmosphere. Ureas may show considerable surface crazing if exposed to repeated wet and dry conditions. Melamines do also if improperly cured. Tableware should be adequately "cycled" with wet and dry conditions to safeguard consumers. The temperature at which drying occurs can also influence the results. Rapid drying of amino plastics accentuates crazing conditions.

The presence of metal inserts can considerably affect the strength of the molded part because of the difference in shrinkage between metals and plastics. Localized stress may sometimes be of sufficient magnitude to cause cracking or, under slight external stress, failure of the part. Only testing of the final article will show up this weakness.

One of the new tools of consumer testing that we find of immense value is X-ray analysis, by which, either fluoroscopically or by means of X-ray film, we can study the in

(*Continued on page* 100)

X-rays show porosity in one section of a block (left) and positioning of the insert in a cook-stove knob (right)

This insulating block, made of canvas-base laminated, grade "C" Dilecto, is used in electrical switch boxes for signal equipment. To meet service requirements it must be structurally strong—and retain its electrical insulating properties under the extremes of temperature and moisture. It also must be easy to machine to meet volume production schedules and be dimensionally stable to facilitate installation.

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Automatic Box Folding

Development of new machine moves the plastics industry closer to goal of eliminating all manual operation in container fabrication

By William Schack

plastics Field Editor

AUTOMATIC machine production of plastics containers—long a problem with which fabricators have been much concerned—has just moved a long step toward solution with the development of an almost completely automatic machine for making folded plastics containers. This machine, first publicized in the **plastics** DAILY published during the recent SPI Exposition and Conference, was devised by John H. Oxley, Watertown, Mass.

Unlike the automatic forming machine (itself an important development) devised by the Celanese Plastics Corporation during the war for drawing out a small container of cellulose acetate (see "Container Fabrication" in this issue), the Oxley machine does not draw—it folds the sheet from which the box is made.

Oxley has built some 30 machines and himself produces boxes from *Vinylite* and cellulose acetate sheet. The machine can handle any gauge from .005 to .040" and any size sheet up to 24". The only potential limitation on the size of box it can make is, in fact, the size of sheets commercially available. Already it is producing containers small enough for ear-rings and large enough for blankets. The tiny boxes are fashioned from the end cuts for the larger containers, thus avoiding a possible waste of material.

As for gauge, Oxley recommends the .015" sheet as giving ample rigidity for ordinary packaging of candy, soap, stationery, and similar articles, though there is no technical difficulty in folding the heavier gauges.

Corners of the boxes are solid and clean-cut, and need no cement or solvent, for the essential principle of the machine is to achieve the closed form by an overlap of material, not by adhesion. The overlap is obtained by a strip heater with rheostat control which heats and bends the sheet at appropriate points. In some cases the boxes have a double wall of the material used; in others, there is only a kind of wing overlap. In any case, the construction of this box eliminates need for beading processes and that without any concession to overall strength.

As production is set up at the company plant, a row of machines on one side turns out the tops of the boxes, and a row on the opposite side, the bottoms. The two are assembled at the end of the bench. Obviously, each part can be made transparent or in a different color—solid or mottled or otherwise patterned. Although the boxes are usually made from press polished stock, some customers desire the calendered, without the high gloss. The Oxley plant also makes its own tinted stock by dip-dyeing in a nonflammable dye.

(*Continued on page* 98)

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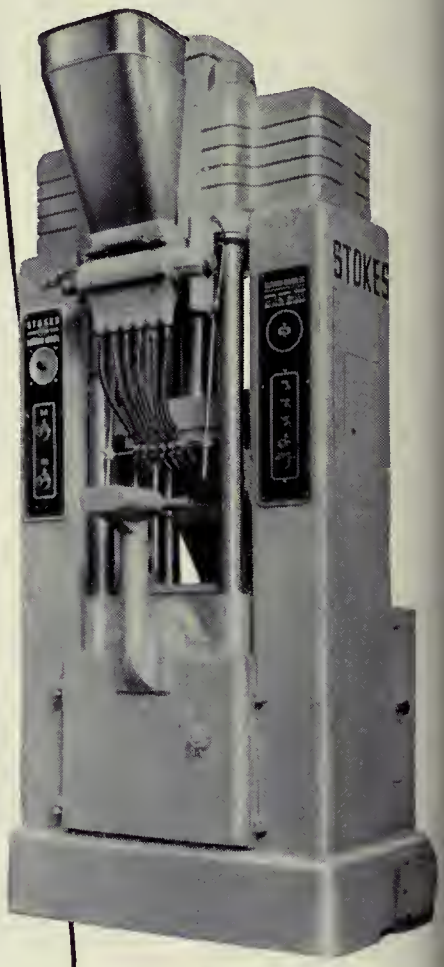

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SPI's West Coast Exhibit

THE plastics exhibit held during the spring conference of the Pacific Coast Section, Society of the Plastics Industry, emphasized common and trade names for synthetic resins and what performances may be expected from them, stressed the fact that plastics are made from abundant materials, advanced plastics in the public eye through education, and displayed countless items molded and fabricated for industry and consumer use.

Displays traced the development of a finished product from the basic ingredients, such as coal, limestone, and water, and plastics materials were exhibited in resin, flake, granule, powder, and sheet forms. Methods of fabrication and molding were also stressed.

Manufactured items were classified and exhibited according to their applications. Thus, there were groups of electrical items, automotive items, household hardware, packaging, cosmetic containers, and many others.

Besides plastics fabrics, under many trade names, and plastics applications in the movie industry, including "medieval" armor, acrylic sheets used as glass when actors leap through windows, and other props, the following products were among those featured at the show: acrylic musical instruments; furniture; lamp bases and shades; lighting fixtures, including light-transmitting rods; artificial flowers; carvings and statuettes; sporting goods; desk equipment; printing equipment; tools; radio cases; optics; toys; nursery items; window screens; drapes; and rugs.

In the musical instrument section was displayed the Rohm & Haas cemented *Plexiglas* violin, fabricated in Germany in 1937. A mandolin and a ukulele, made by J. Fred Williams, Huntington Park, Calif., were also on display. They were of combined *Lucite* and *Plexiglas* cemented with ethylene-dichloride. A mandolin case, also made by Williams, was of fabric-urea laminate with acrylic fasteners and hinges.

Unusual furniture items included a glass-topped tea table with tubular acrylic legs and an acrylic vanity chair with a curving, form-fitting, waist-high back.

As the spectators entered the Exposition Hall, they faced a scale acrylic replica of a GI-M-AVI cargo vessel, as built during the war for the U. S. Maritime Commission by Consolidated Steel Corp., Wilmington, Calif. The replica's parts were detachable to correspond with sections of the ship's assembly. The model had been employed hundreds of times to train shipyard workers in building cargo vessels.

An acrylic globe containing acrylic rods featured the ability of the rods to transmit light.

Among the machinery on display, besides the injection and compression presses shown, were preheaters, a welding gun for laminating; and a hydraulic laminating and laboratory press.

Horace L. Blackman, president, Calplasti-Corporation, Los Angeles, was general chairman of the show. Dean R. Ebey, Dow Chemical Co., Los Angeles, and Donald R. Brooks, graphic artist of the Exposition Building, designed displays showing how raw materials become synthetic resins.

It is estimated that approximately 200,000 persons saw the exhibit during its five weeks' "booking." It was jointly staged by the Pacific Coast Section, SPI, and the staff of the State Exposition Building.

END

Fragile appearing, yet having fine tonal quality, violin is of "Plexiglas," while ukulele and mandolin are fabricated of "Lucite"-"Plexiglas" combination. Below, Lighting Specialties used polystyrene and cellulose acetate with glass and metal for unique show booth light fixtures

BLANKING THERMOPLASTICS

The spectacle frames and the acrylic backs of the baby brush and of the complexion brush were produced by blanking

Alert fabricators will not overlook the advantages of efficiency and economy to be gained by the correct choice of cutting method

AS IS the case with other materials, blanking, punching, trimming, or otherwise cutting plastics to shape offers an economical method of obtaining flat pieces of definite outline from sheet stock.[1] Though the procedures involved are as a rule extremely simple, there are distinct limitations to their application.

The ease with which various plastics can be blanked or cut varies widely, as do the preferred temperatures to which the materials should be preheated and the thickness of sheets which can be cut.

Blanking, punching, and trimming have been used in the fabrication of articles from cellulose nitrate for so many years that they are ignored by most of the texts on the subject.[2] With the possible exception of polyethylene, it may be considered as the easiest of the plastics to work in this fashion. Cellulose acetate also has been widely worked by this technique. More recently blanking has been adapted to the fabrication of articles from methyl methacrylate resin, although the operation requires greater skill. Ethyl cellulose, vinylidene chloride polymer, vinyl chloride copolymer, casein, and thin sheets of polystyrene are also amenable to fabricating by these techniques.

For many years, blanking of cellulose nitrate and cellulose acetate has been used in the production of brush and mirror backs, combs, buttons, toys, ornaments, dolls' eyes, spectacle frames, bag frames, nail polishers, manicure file handles, puff boxes, face-shields, washers, shims, card cases, make-up boxes, and a wide variety of advertising novelties. Such articles are still produced in quantity from both cellulose acetate and cellulose nitrate plastics.

Although for very small production sawing is frequently resorted to, for large-scale production blanking rather than sawing or turning may result in a cost saving of as much as 40 to 50% in the cutting operation. The amount of this saving will vary according to the quantity of items produced, the type of plastics used, the efficiency of the shop and possibly other factors.

Obviously, even the low cost of a blanking die will not be justified if only a few articles are to be manufactured. Since first-class blanking dies cost only about one dollar per inch of edge to be cut, a simple measurement of a proposed article and a knowledge of the number of pieces which are to be produced will determine whether one is justified in using this procedure.

In the case of relatively thin articles, such as dolls'-eye covers, card-case windows, and small cup-shaped pieces, it is sometimes quite feasible to produce a finished article, shaped or slightly drawn if necessary, ready for use. With thicker articles, such as mirrors, brush backs, bag frames, etc., the usual operations of routing, sanding, ashing, and polishing are carried out on the blanked form in exactly the same manner in which they would be applied to a sawed

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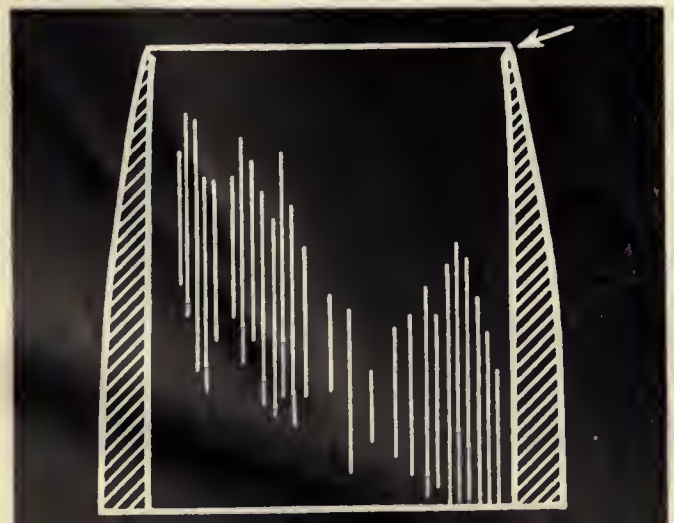
The most practical dies for blanking plastics are said to be open-faced dies, a wide variety of which are shown

In the free-hand blanking operation, the open-faced dies used can be moved around at the will of the operator. Below, cross section of an open-faced die shows the chisel beveling which enables the die to pick up the cut piece



piece. In some articles of this type, depending upon shape and quality of finish required, the blanked edge is smooth enough so that a simple tumbling, ashing, and polishing procedure will yield a satisfactory finished product.

Presses are available commercially for blanking, trimming, or punching operations. The selection of a specific type for any given job depends primarily on the size of the pieces to be cut and the rate of production desired. In general, the speed of such presses ranges from 50 to 200 strokes per minute. Large pieces or heavy sections are usually blanked at slower speeds with a heavy press.

A cutting board is mounted on the base or on the head of the press. Its function is to back up the sheet of plastics at the moment of impact and to prevent dulling of the edges of the dies. The cutting board can be made from cellulose nitrate plastics, vulcanized fiber, aluminum, soft brass, copper, end-grain wood, or any of a wide variety of unfilled hard composition boards. Provision is usually made to permit the shifting of the position of the blanking die in order to avoid localized wear of the cutting board.

Three types of blanking dies are commonly used, as well as conventional punches and dies such as are used for metal. The use of the latter type is ordinarily limited to thin sheets or to impact-resistant plastics such as cellulose nitrate, ethyl cellulose and polyethylene.

(1) The most practical die for blanking plastics of all types is the open-faced die. Such dies are made from tool steel approximately ¼ to ⅜″ thick at the base or blunt end. It is of utmost importance to construct all dies with the same overall height, which should be standardized at 2¾″.

The practice (a) permits safe operation, since it allows sufficient clearance for the operator's hands and wrists, (b) eliminates the otherwise frequent change of height of ram, (c) prevents the breaking and bending of dies which are encountered when dies of various heights are used in the same press, (d) makes it possible to interchange dies of different size on the same sheet (e.g., for brush backs, and for handles for mirrors and small articles), without removing the sheet from the press, and (e) permits the more economical production of dies, since smaller stocks of steel bars in a single width are required and since machinery set-ups do not have to be changed.

These dies can be used for either large or small production runs, and are accurate in dimensions and economical to maintain. In spite of their initial cost, they are more economical to use than the lighter, less expensive types which will be described later. Dies of this type are not fastened to the press as a general rule, but are handled by the operator and can be moved around at will. This form of working is called freehand blanking. The dies are ground and polished on the inside. They pick up the cut piece as the result of a slight chisel-beveling on the inside of the die at the cutting edge.

(2) The steel-rule die is most generally used for limited production, except when it is set up in a fixed position and supported. Its principal use is for trimming to shape previously cut rectangular pieces. It should not be used on sheets of a thickness greater than 0.080″. Such dies can be used in the blanking of pieces of large area where the cost of a steel die becomes prohibitive. A variation of the steel-rule die known as a clicking die may be used for material up to 0.125″ in thickness.

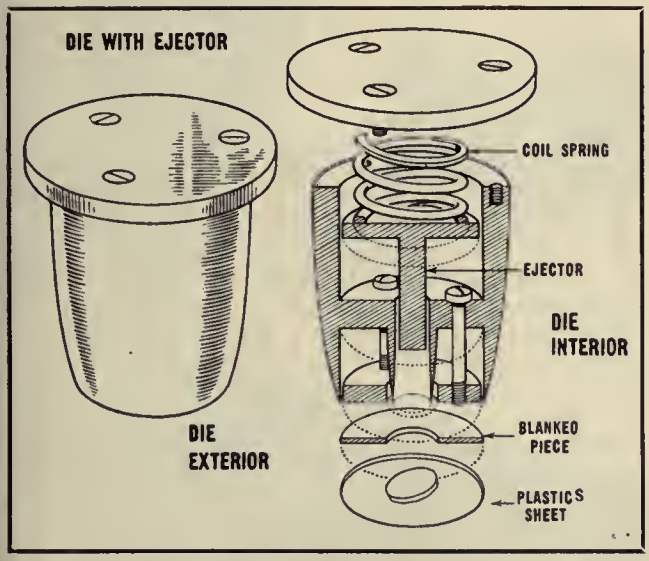
Both of these closely related die types are made up of a thin steel ribbon bent to the desired pattern and mounted in or around a plywood backing plate. The exposed edge is razor-sharp, and at intervals along the periphery, or inside the pattern itself, there are rubber stops to hold the plastics in place prior to cutting and to eject it from the die when the operation is complete. The thickness of the steel ribbon is determined by the thickness of the plastics which is to be

Sheet material and blanking board (left) are placed in position prior to being slid into press in a steel-rule die blanking operation. At right, the transparent sheet is placed in position before being slid into a press in a clicking die operation

cut, as well as by its nature. Both of these dies are relatively cheap and are adapted to types of work where there are frequent style changes.

(3) The ejecting outline-blanking die is similar in construction to the open-faced die, but the inner wall is ground differently, and provision is made for the die to eject the cut work rather than to pick up the finished pieces. It is usually made from tool steel of the same types and generally has about the same cross-sectional configuration. It is most useful for sections having a center cutout, such as a washer. It may be used for freehand blanking or it can be mounted on the base or on the ram of the press.

In order to prevent binding and to permit easy ejection of the blanks, the inside walls of the open-faced die should not only be polished but should be straight for approximately ½" and then tapered, so that the area covering the top of the die is greater than the area at the bottom or along the cutting edge. In the case of the ejecting outline-blanking die, keenness of edge and degree of polish on the inner face are important factors. Great care should be taken in handling and storing dies so as to avoid the need of excessive grinding and stoning. After use, dies should be dried thoroughly and oiled, and the last blank cut left in the cutting face before storing. They should be stored in an inverted position, i.e., with the sharp edge up. The cutting edge should never be allowed to come into contact with metal or other hard materials.

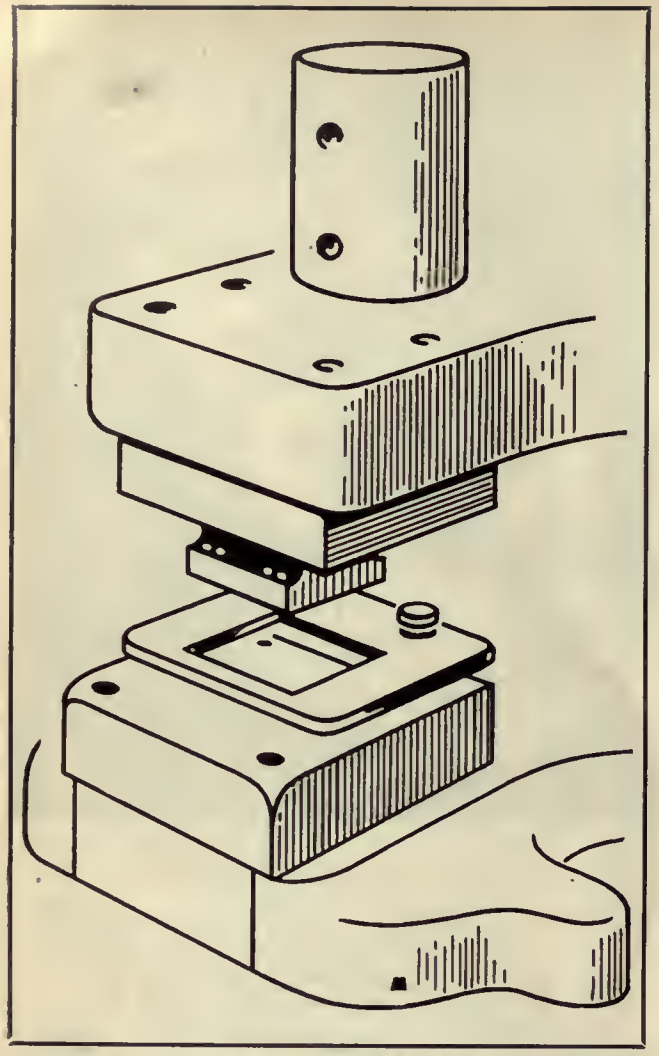


Ejecting outline-blanking die is made to eject cut pieces

Punching involves the use of a punch which passes into a closely fitting die of the same configuration. This operation on plastics is quite similar to that which is quite frequently practiced on other light-gauge materials. Dies and punches are usually constructed of tool steel and are made to extremely accurate dimensions so that pieces, or holes in pieces, can be expected to have a precision of dimensions not usually obtainable by blanking methods. This technique is often used where the finished piece must fit accurately over or into another part, or when there are several holes that must be definitely aligned or spaced.

In the construction of blanking dies, the use of a ledge around the top or base of the die is sometimes suggested as a safety precaution, to prevent pinching of the operator's fingers between the press head and the die. These ledges, however, introduce a further hazard in that they prevent the operator from viewing his work clearly, and consequently there is another school of thought which prefers the use of hand holes or grips tooled into the outer contour of the die, which will enable the operator to position his hands safely and at the same time give him full view of the work.

It is generally desirable to heat or otherwise condition



Punching machine. Note punch and die of same configuration

sheets of plastics prior to blanking. Such heating is generally done either in ovens or on tables, though in some cases immersion in hot water or hot oil has been practiced and more recently high-frequency "radiation" has been used, at least in an experimental way.

The roughness or smoothness of the edge of the cut blank will depend on the temperature at which the material is blanked as well as on the condition of the die itself. Properly cut blanks have sharp, smooth edges.

Ovens can be heated by steam, electricity, gas, or infrared radiation. In the case of cellulose nitrate plastics, steam or hot water is to be preferred because of the flammability of the material. In any event, regardless of material, ovens should have thermostatic temperature-regulators.

Tables can likewise be heated by steam, electricity, gas or a so-called "steam-electric" system. Control of temperatures of the heated sheets can in some measure be regulated through the use of insulating and covering pads of canvas or cotton cloth. In most cases the operator's judgment as to proper stock temperatures must be relied on, not only to determine the point at which the material is ready for blanking but also to determine, for heavy sheets, the best time at which to turn the sheets or pieces over so that they become thoroughly heated through.

Ledge (left) and tooled grip (center) are used on blanking dies to avoid pinching fingers between press head and die

Proper Layout Essential to Economy

The economical use of sheet materials in the production of blanked parts depends almost entirely upon a proper layout of the work. Best results can be obtained by a careful geometric analysis and an actual to-scale layout of the outline of the desired piece on a sheet of the specified size. Frequently several paper or cardboard patterns cut to the desired outline of blanked piece can be used to advantage in quickly ascertaining the most economical way of cutting the sheet, through actually placing these patterns on the sheet itself. Such a study pays dividends in that it is often possible to obtain many more pieces from a given area than is apparent from a casual calculation. Thus, one can obtain a much greater number of hairbrush backs from a sheet if the blanking is done according to a predetermined pattern in which the handle sections of one row of brushes interlock with the handles of the next row.

Sometimes it is found advisable to blank pieces from sheets in successive steps, taking the largest piece first, and then the smaller pieces afterwards from the so-called "skeleton" or scrap. Similarly, irregularly shaped objects may be interlocked to leave a frame or skeleton from which smaller objects can then be cut.

It is generally possible to blank plastics with an accuracy of approximately ± 1/64″. In some cases considerably better accuracy has been attained, but due allowance must be made for thermal shrinkage, since it is generally necessary to preheat all but the thinnest of sheet material. Thin sheets at room temperature can be punched to an accuracy of ± 0.002″ or better.

Preheating

Preheating of sheeting prior to blanking or punching operations, as previously stated, depends not only upon the size, shape and condition of the die but also upon the nature of the plastics. In the case of thin sheets, that is, in thicknesses up to 0.035″, preheating is generally unnecessary. For heavier gauges, the temperatures outlined below are usually adhered to with the more rigid materials.

Polyvinyl butyral sheeting of the safety-glass type can in most instances be blanked at room temperature. Such materials in the usual commercial thicknesses of 0.015 to 0.035″ offer no particular problems.

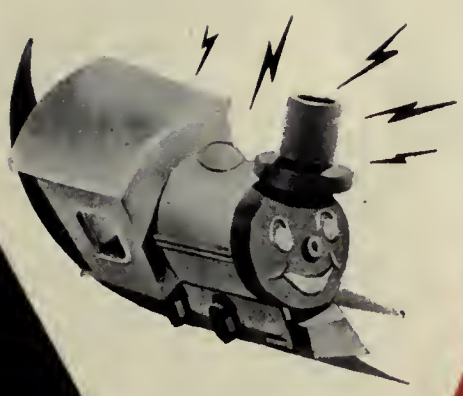
Polythene (polyethylene) also can be blanked or punched at room temperature. In extremely thick sections, it is sometimes heated to a temperature of about 100° F. This material is so readily cut that thicknesses up to an inch can be so worked.

Cellulose nitrate sheeting in light gauges is generally blanked or punched at room temperature. In heavy gauges, ¼″ and over, it is sometimes heated as high as 210° F, generally by immersion in hot water. Cellulose nitrate is frequently blanked in gauges up to ½″.

Cellulose acetate sheeting in thin gauges is quite fre-

(*Continued on page* 105)

all 4 toys shown were designed, engineered and injection molded by Universal Plastics Corp



injection molding

plus

designing and engineering, too!

That *plus* means plenty to you if your product's to be injection molded. For our designers, engineers and production experts are at your service — to save you countless hours . . and dollars! Call, write or wire — no obligation, of course.

UNIVERSAL PLASTICS CORPORATION

2 [illegible] A • N Y [illegible] N

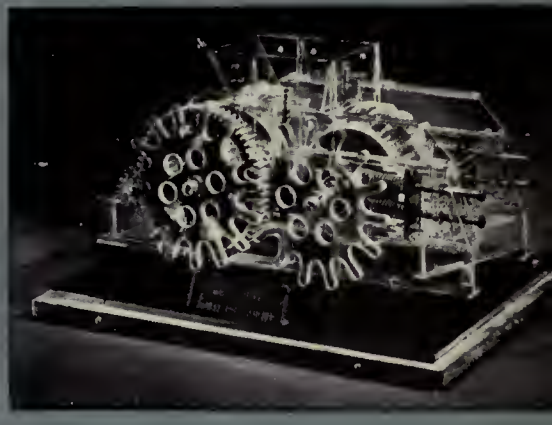
[illegible] M [illegible] 39 0 • P t N B n w t N [illegible] y

Durable and attractive, this car top and uphalstery are af "Duran," made fram B. F. Goodrich Chemical Ca.'s "Gean" resins. Masland Duraleather Ca. makes the material, and claims that it will last the lifetime af any car, is impervious ta oils, sunlight, acids, alkalis. Shawn here in antique ivary finish, it will eventually be available in a wide range af vivid colars

Plastics at Work

Camera enthusiasts will welcome the sturdily built, smart-looking tri-vision camera and viewer, recently developed by the Haneel Ca., Las Angeles. Cellulose acetate is used to make outer cases, as well as for inside construction

Slight pinching with fingers releases ice cubes frozen in Plastray Corp.'s individual, improved "Jiffy Cube" cups, without "fuss, muss, or waste." Of ethyl cellulose, the ice makers are manufactured by Standard Products Corp.



Machine models made of Rohm & Haas Co.'s clear "Plexiglas" are faithful reproductions in every detail, can be operated to demonstrate, providing convincing "sales talk." Carleton Elliott makes the models for Gruendler Crusher & Pulverizer Co.

For a lamp which is modern in every detail, Dorian Studios, Hollywood, uses acrylic throughout—in both gleaming black and clear for the base, and satin finish for the shade. The table has legs of clear acrylic and its plane surfaces are of black, acid-proof "Panelyte"

Decorative, utilitarian, and amusing, this cigarette box of acrylic has a compartment holding Swiss "Thorens" movement which tinkles "Anchors Aweigh." Box is product of Susan Jay Novelty Co., and may be used to hold other items

To bond vinyl handbags with "Pliobond," the adhesive is first extruded into channel of a cellulose acetate frame

After a few minutes, edges of "plastics patent" bag are inserted into prepared frame with a hand tool. Tucking in edge from the outside so that folds have an even appearance completes the process. These are actual production steps employed by Empress Handbag, Inc., of New York

Pliobond —a new ADHESIVE

has proven itself effective for bonding a variety of materials

AN ALL-PURPOSE thermoplastic adhesive, *Pliobond,* which originated in war-time uses, is finding a place in plastics fabrication and assembly. "All-purpose" is not to be taken literally, for the new adhesive has its limitations, but it is said to be effective for bonding a wide variety of diverse materials. Described as "a synthetic elastomer with other synthetic resins," *Pliobond* uses methyl ethyl ketone as a solvent, and its bond strength depends upon complete removal of its carrier solvent by evaporation.

One of its first applications in the plastics field has been in the manufacture of polyvinyl chloride or vinyl copolymer handbags, where the adhesive is used to bond the flexible material to acrylic, cellulose nitrate, cellulose acetate, and other plastics frames, which had often proved a difficult task hitherto. Once the adhesive sets, it remains pliant, yielding to the flexing of the vinyl without cracking.

Pliobond is easily applied in manufacturing these popular "plastics patent" bags, yielding a bond without affecting the materials in any way, according to one fabricator. His method is to extrude a ribbon of the adhesive into the channel of the frame, from the nozzle of a dime-store oil can. After two or three minutes the vinyl material is worked into the channel with a tool, completing the bonding operation. The material is pinched into the frame tightly enough so that no clamps or other pressure need be applied. From this time on the material is sufficiently tacky for the bond to hold under the rough handling it is apt to receive during fast assembly of additional parts into the bag, although maximum bond strength will not be attained for days. The frames are prepared in cycles of 12 to 15 before inserting the vinyl material, allowing partial evaporation of the solvents from each frame for two or three minutes.

A large manufacturer of knitting machines used to employ phenolic laminate riveted to metal in various parts that come into contact with textiles. He now bonds these materials with the adhesive in place of the rivets.

An interesting war-time use was made in the Army's packaging and storage program. Parts packed in oil have been hermetically sealed in aluminum foil on which *Pliobond* was sprayed. Polyvinyl chloride, sprayed on top of this, afforded a plastics protective finish which could not of itself have adhered to the metal.

The Army Air Forces has also utilized this adhesive for cementing small patches over holes and breaks in acrylic turrets and bubbles. They find it suitable for this purpose despite the yellowish cast of the cement.

Manufactured by the Goodyear Tire and Rubber Company, *Pliobond* is distributed by the United States Plywood Corporation. Among the properties attributed to the ad-

hesive are resistance to mildew and fungi, high electrical insulating value, high water resistance, resistance to dilute acids and alkalis, and corrosive salt solutions. It is soluble in ketones and esters, but not in petroleum and coal tar solvents, lubricating oils, alcohols, ethylene glycol, and most chlorinated solvents. Because of its flexibility, *Pliobond* is particularly applicable where shock resistance is of importance. As an elastometer, it is permanently flexible, and does not become brittle upon aging or when exposed to relatively low temperatures.

Limitations in the use of the adhesive are suggested by the following factors. Its thermoplasticity renders it generally unsuitable for bonding structural members, as it undergoes cold flow and will creep under constant high stress. Although it will not withstand continuous applications of heavy loads in shear or tension, often intermittent strains and loads can be accommodated, depending on the material bonded.

The thermoplasticity of the cement makes it unsuitable for use at elevated temperatures. Although the softening point is not sharp, it has been found that 170° F is the highest temperature under which it may be used favorably.

Upon drying, *Pliobond* has a slight residual odor, which may be minimized by addition of a masking agent. Other bonding agents carried in solvents also have such odors.

The cement sets in an amber color, and so cannot be used where all-over transparency is required, as in decorative clear acrylics. However, the addition of oil dyes will change the color to blend with colored transparent materials or to blend with colors where glue line is exposed at a seam.

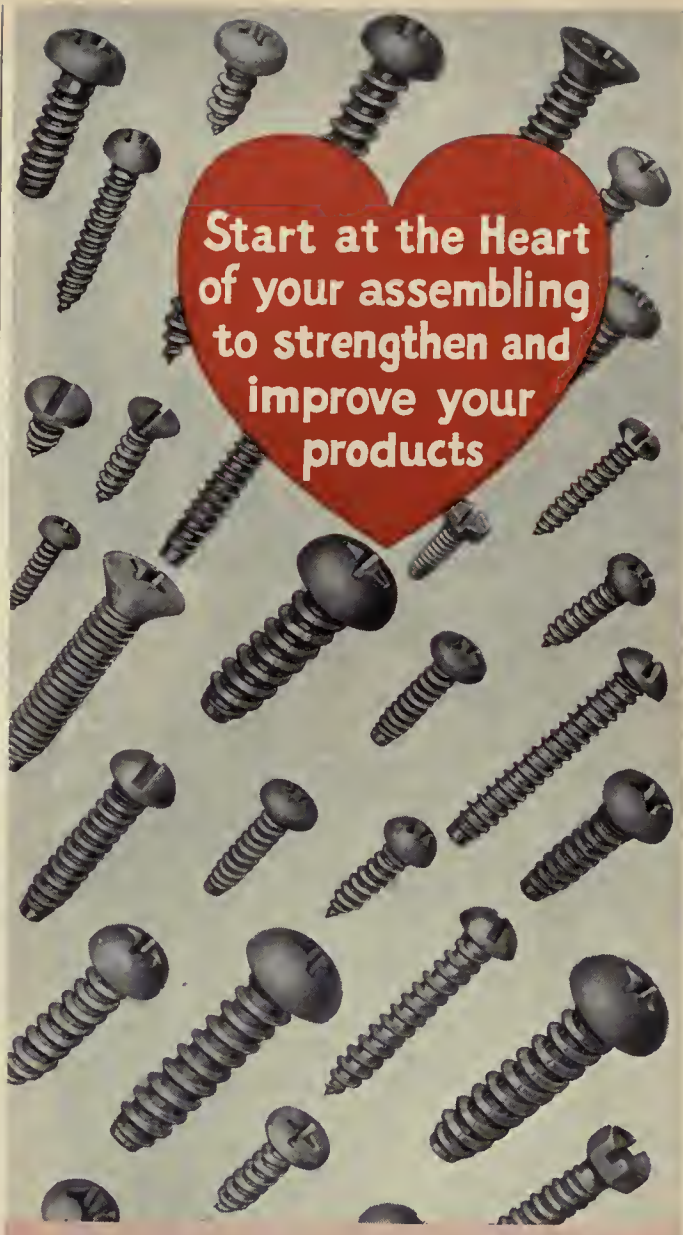
The cement is marketed in two forms, *Pliobond 30*, a 30% solids solution, and *Pliobond 20*, a 20% solids solution. The first is generally used where porous surfaces are involved, and the latter for dense surfaces. The cement may be applied by brushing, spraying, roller coating, knife, or dipping after the surface to which it is to be applied is cleaned thoroughly of scale, rust, dirt, grime, etc. Results on plastics vary, depending upon the amount and type of parting agent used in laminating or molding. Generally, it is sufficient to sand the plastics with fine sandpaper, but, in cases where this is not successful, particularly with thermosetting plastics, alkali degreasing is recommended. On plastics films, no special preparation is necessary.

Methods of Assembling

There are three methods of assembling with *Pliobond*, depending upon the porosity of the materials to be joined. These are cold or wet bonding, reactivation bonding, and hot or dry bonding. In general, the strength of bond obtained with heat and pressure is superior to that obtained by room temperature methods.

Since the cold or wet bonding method is quickest and easiest, it is often used where one or both surfaces are porous (cloth, paper, wood, etc.). Pressure must be applied for periods ranging from fifteen minutes to overnight. The reactivation method, which may be employed when one surface is porous and the other non-porous, depends on the fact that although a hard film will form on the surface of the cement when exposed for a short period, it will not have set beneath that surface. Therefore, wiping the surface of the denser component with a solvent such as methyl ethyl ketone restores it to the wet state, and it is then joined with the other surface and placed under pressure as in wet bonding. Hot or dry bonding utilizes, to an extent, the thermoplastic nature of the adhesive. When bonding two non-porous surfaces together, it is necessary to remove the last vestiges of residual solvent from the *Pliobond* film. This is done by drying under temperatures "stepped up" according to a schedule. The assembly is then hot-bonded to form a laminate either in a hot-press or under pressure in an oven.

(*Continued on page* 105)



Rugged, precisian-made HOLTITE "Thread-Forming" screws insure enduring, trouble-free perfarmance. Drive'em and farget'em! Engineered fram raw material to final finishing ta provide smaath, speedy applicatian in any material. Save tapping casts . . . eliminate waste and spailage — specify HOLTITE. Our laboratary and engineering facilities are always available far the solution af yaur fastening prablems.

HOLTITE-Phillips Recessed Head Screws permit safe power driving on jobs previously limited to slow hand driving. Cut fastening time in half . . . strengthen assembly . . . add to the appearance of your product.

CONTINENTAL SCREW CO. Established 1904 • New Bedford, Mass. U.S.A.

Applied with spray-gun over taped foundation, fine tenacious threads of "Saran F-120" afford protection

Packaged for Preservation

From foods to heavy machinery a wide range of products can be protected and preserved by means of convenient, plastics packaging

PACKAGING for all types of goods has come into new prominence, the term now being used to denote various types of containers and coverings not, until fairly recently, included in the category. We've obviously progressed a long way from the "cracker barrel" days of great-grandfather's time, when food and other perishable or fragile merchandise was exposed to contamination from dust, germs, flies, etc., and could be handled and soiled by many hands before reaching its ultimate purchaser. This progress was well demonstrated at the 1946 Packaging Exposition, sponsored by the American Management Association, recently held in Convention Hall, Atlantic City.

Protective packaging has of course reached into other realms than that of perishable goods, including the field of heavy equipment and machinery. In covering equipment of this type for protection during a long-time storage period, or during shipment, from various deteriorating influences and elements (moisture, rust, etc.), spray-packaging has supplied a quick and easy method. Developed as "dehydrated packaging" during the war, spray-packaging technique is now being used in the storage of surplus war equipment as well as in civilian industry. It actually consists of provision of a moisture-vaporproof covering and includes the use of desiccants to absorb any moisture which might be present within the "package" formed by the sprayed-on coating.

"Lumarith" foil keeps vegetables clean, fresh-looking

Two new coatings recently announced by the Dow Chemical Co. as members of the company's *Saran* "family," lend themselves admirably to the spray-coating technique. These coatings, designated as *Saran F-122* latex and *F-120*, a solvent soluble resin, were first introduced publicly at the Packaging Show.

F-120 is described as producing extremely dense, smooth coatings, completely waterproof and possessing much higher-than-average proof against moisture vapor; in this regard, it is said to represent the closest approach to metal foil which can be found among commercially available synthetic resins. Coatings based on *Saran F-120* are characterized by a high degree of resistance to solvents, oils, greases, acids and alkalies; are odorless, tasteless and produceable in varying degrees of flexibility and hardness.

The first step in spray-coating is to use a paper or cellulose tape to bridge over projections, forming an open network as a basis for the first coating, and applying such tape around, over and underneath the article. The necessary desiccant units should be placed in or around the assembly or machine and secured firmly, before the taping, thus preventing shifting of these units, with possible resultant punctures.

The solvent soluble *Saran F-120* is now applied with spray gun over the taped structure, the nature of its formulation being such that as it is forced through the spray tip and exposed to air, it emerges as a mass of filaments, forming a taut, cobweb-like blanket for which the tape serves as a framework. This webbing is built up to a density sufficient to keep the second coat from dripping through it (one hour is sufficient time for drying before applying the next coating).

The package is now ready for the final coats of *Saran F-122* latex, which is also applied with a spray gun. It is desirable to apply at least two coats of latex in order to obtain sufficient toughness and resiliency to reduce possibility of puncture or similar hazard which the package might encounter in transit. With the proper viscosity, a heavy coat of *Saran F-122* can be deposited with each pass or application, about one hour being required for drying time between the first and the second coating. If subsequent coats are used, the requisite drying time is slightly longer.

When a variety of items are to be packaged, the final *Saran* coating is available in colors, providing aid in identification.

Elimination of toxicity and fire hazards, as well as avoidance of costly solvent recovery, are promised with use of *Saran F-122,* by its makers. Easily dried, presenting no solvent retention problem, requiring no baking, and with viscosity easily adjustable over a wide range, it can be used in conventional coating methods, including roller and doctor, as well as spray types.

In applying the *Saran* coatings, no special devices are required, standard paint spray equipment having been found entirely satisfactory, says the Dow Co. Cleanliness of the spray system is, of course, of utmost importance when spraying the latex, in order to prevent slug formation through localized coagulation, and for this purpose, cleaning the system with the correct solvents or thinners, followed by a flushing with water containing a little mild soap, is recommended by the company.

A pressure system is advised, in preference to a suction system, with fluid pressure regulated in the range of 3 lb-15 lb to accommodate latex viscosity in the range of 25 centipoises-4000 centipoises. Correspondingly higher pressures will be required if the material must be raised to any appreciable height above the reservoir. Atomizing air pressure should be regulated in the range 45-60 lb as required for levelling the finish. While the use of a stainless steel type gun is not necessary, it is recommended that if ordinary steel contact parts are used they should be washed immediately after use and dried by flushing with acetone or alcohol. The DeVilbiss *Type E* tip and needle with a DeVilbiss *No. 24* cap or a similar combination which provides a high ratio of atomizing air to liquid has been found satisfactory by the Dow Co.

"Packaged" with these *Saran* coatings, the equipment is provided with a continuous, tough and leatherlike covering, with an extremely low rate of moisture vapor transmission impenetrable by dust, dirt, salt spray, chemical fumes or other corrosion-producing elements.

Greater Dryness Possible

Various factors govern the use of spray packaging and, in some instances, where packages are to be exposed to particularly hazardous conditions, a higher degree of dryness than that obtainable by means of the two coatings may be necessary within the package. A coating of *X-316 Saran* lacquer is used in such cases as an intermediate step, after the coatings of *F-120* and before the first application of the *F-122* latex coatings.

The amount of desiccant used is determined by the length of time that protection is required; nature of the item which is to be packaged; and final storage area. There are formulas available, giving requirements to meet the number of months or years of preservation required. Requirements for a satisfactory desiccant are that it must be highly absorbent; economically practical; noncorrosive in itself; and non-liquefying. Silica gel, meeting these conditions, is about the most widely used drying agent for this purpose.

To allow for periodical inspection of the package for any signs of appearance of moisture, a transparent window of moistureproof, one-ply *Saran* film may be arranged by cutting a square in a convenient place, prior to the final latex coating, and a humidity indicator placed where it is visible through this window.

Besides their spray-coating uses, *Saran F-122* and *F-120* have respective application as coatings for paper, fiber, textiles, metals, leather, films and foils, and, aside from the coating field, are applicable as bases for various adhesives and cements. Both are said to possess *Saran's* inherent resistance to water, chemicals, greases, oils and solvents.

The use of plasticizers is not required by *Saran F-120* in

(*Continued on page* 99)

Here's a call that's being repeated regularly these days by manufacturers who have discovered that Larry Cook's compact organization offers New England's most complete, most capable, small-shop plastic mold service.

Whether the problem is design, development or manufacture of injection, compression or extruding molds, the call for "Cook Capability" brings forth the right answer.

Write Larry Cook, discuss your present plastic mold problems with him . . . his advice will be valuable and of course, free of any obligation. Do it NOW!

LAWRENCE H. COOK, INC.

65 MASSASOIT AVE., EAST PROVIDENCE 14, R. I.

TELEPHONE EA. 3881

WHAT'S *New* IN PLASTICS

Self-Tapping Screw

Parker-Kalon Corporation
200 Varick St., New York 14, N. Y.

Designed for making fastenings to comparatively thin sections and bosses in friable and brittle plastics, the *F-Z* self-tapping screw permits the elimination of inserts in plastics assemblies without sacrificing strength, and at comparatively low costs.

The minimum stresses set up as the screw is driven permit the design of plastics shells with more uniform wall sections. Cutting pressure is evenly distributed and localized pressure and cracking is prevented by the screw's five cutting flutes, which permit the chips to drop to the bottom of the hole. Course threads eliminate binding by acting as an additional reservoir for the displaced material. .....(520)

Die Casting Machines

Hydraulic Press Mfg. Co.
Mount Gilead, Ohio

New high pressure die casting machines for casting magnesium, aluminum and copper alloys are of revolutionary design in that mold clamping, metal injecting, core pulling and ejecting units are all operated by direct hydraulic means. According to the manufacturer, these machines have injection capacities from 12½ to 100 cu in. per cycle. Injection pressures range from 6,000 to 50,000 psi, depending upon plunger dia.

Two standard models are now in production—the *400-A* for casting aluminum, and the *400-M* for magnesium. Having a maximum injection speed of 750 in. per min, model *400-A* uses straight-line hydraulics, the injection ram being directly connected to the *HPM Hydro-Power* radial pump. On the magnesium machine, a nitrogen accumulator activates the plunger, providing injection speeds up to 7,200 in. per min. This model can also be used for die casting other alloys, since the injection speed is adjustable.

A straight-line hydraulic clamp which seals the mold halves during the injection part of the machine cycle, is an outstanding feature of these machines. A small internal booster ram is supplied with the double acting main ram which provides for the rapid advance of the movable mold half. Slam and shock to the mold halves are eliminated by the automatic reduction of closing speed just before mold contact. Clamp pressure, clamp stroke, and slow-down position are adjustable. A hydraulic knock-out in the mold clamp platen and hydraulic pressure for pulling cores automatically, are provided.

The operator starts each cycle of the machines with an electrical foot switch, and although the balance of the cycle is automatic, manual controls are provided so that each unit can be operated independently .....(521)

New Molding Press

Van Dorn Iron Works Co.
2685 E. 79th St., Cleveland 4, Ohio

Designed to meet the demand for a simplified, easy-to-operate injection press, the new power-operated Van Dorn Model *H-200* is adaptable to many requirements in production, research and instruction use; is efficient and low in cost.

Its 1-oz injection capacity can be used for producing either single, or multiple parts totalling that weight. Minimum mold thickness is 3", maximum mold thickness 8½", platen area 8" × 8", and mold opening 6".

Hydraulic cylinders operate the plunger injection and mold closing. Up to 1,500 lb line pressure is obtained by a gear type pump driven by a 2 hp electric motor. The automatic ejection of parts is accomplished by a simple knock-out and ejector pin arrangement, which eliminates handling of molds and speeds up removal of finished parts. Heating bands arranged in two zones provide automatic temperature control. An individual thermostat within plus or minus 6°F maintains the temperature in each zone. Range of the thermostats is from 100° to 500°F.

The lower mold costs, reduced set-up time, and adequate production speeds claimed for this press assure economical production of many plastics parts.....(522)

New Surface Pyrometer

The Pyrometer Instrument Co.
103 Lafayette St., New York 13, N. Y.

Designed to meet increasing requirements for precision accuracy, this instrument is completely self-contained, portable, compact and quick acting. Its shock-, moisture- and dust-proof steel housing renders it immune to external magnetic influences. A dia indicator of 4¾" with a 4" direct reading scale provides for the fast and accurate reading of temperatures.

Eight thermocouples, designed to eliminate temperature gradient errors; two types of extension arms, all interchangeable without adjustment or re-calibration; and a selection of five different temperature ranges from 0-300° F to 0-1200° F, are unique features which make this instrument easily adaptable to the surface temperature problems of the plastics, steel, chemical, textile, paper, and many other industries.....(523)

Speedy Insert Removers

Keller Tool Co.
Grand Haven, Mich.

A faster and more powerful insert-removing tool is reported by its manufacturers to offer advanced adaptability, highly increased rotary power, and a reduction of insert-removal time and operator fatigue. Broached-through sockets with a ⅜" sq hole allow insertion or removal of both internal and external threaded inserts.

These removers come in two models—*1458* which is reported to deliver four times more stall torque than models previously used, has an 8 ft lb torque, and socket speed of 300 rpm. Model

In rapidly-moving times such as these, keeping up with every latest development in one's field is a "must." In order to simplify for our readers the task of obtaining detailed information regarding the new products, processes and trade literature described herein, ***plastics*** has keyed each item in this section with a number, and has provided the name and address of the manufacturer or producer of each.

Mention of the key number, and of the issue of ***plastics*** in which the news item appeared, will serve as quick identification of the product when writing the individual manufacturer or producer for further details.

1459 has three times the speed of its companion model, and a torque of 2 ft lb. Both tools run in either direction; weigh only 2½ lb. ..... (524)

Heat Sealing Tool

Sta-Warm Electric Co.
Ravenna, Ohio

An electrically heated tool designed for the sealing of various plastics materials as *Cellophane, Pliofilm, Koroseal, Vita-Film,* etc., the *Pistol-Grip Heat Sealer* is used for sealing straight seams, vari-shaped containers, and other articles.

Proper shading of heat for various gauges, plies, and types of materials is provided by the rheostat control which has 150 temperature settings. Maximum heat conductivity is obtained by the self-lubricating sealing roller made of a bronze alloy. This is mounted on tapered copper shanks, and is easily removed from the socket when cold. The interchangeable rollers are available in widths of 3/16, 3/8, ½ and 5/8"; and in 2 patterns, plain and ridged tread. ..... (525)

Pre-Sharpened Tool Bit

Fearless Tool Company
1234 S. Gramercy Pl., Los Angeles 6, Calif.

Its manufacturer announces the *Shearcutter* as an outstanding new tool bit which takes cuts 2 to 3 times its nominal size and greatly reduces production time and costs. It may be used on metal, copper, brass, plastics, steel, and many other materials without changing the original grind.

Faster cutting speeds, lack of the heat usually generated by cutting action, and saving in wear and tear of machine tools are among its unusual characteristics. Precision tolerances may be held with the *Shearcutter* bits, and finishing cuts may often be eliminated. It works on the principle of molecular cleavage, and is said to cut the material with a knife-life action instead of chiseling it off..... (526)

Weight and Tension Indicator

W. C. Dillon & Company
5410 W. Harrison St., Chicago 44, Ill.

Announced as a combination of the *Dillon Dynamometer* and scientifically balanced self-synchronous motors, the *Tens-O-Trol* remote tension and weight indicator is said to offer super visibility, ultra-sensitivity, and a fool-proof hookup.

The complete unit, consisting of master transmitter and two repeater stations, requires only 12 v for operating. Temperature changes have no appreciable effect on it, and the system continues to function perfectly even though voltage may drop several points.

The master indicating motor is mounted to the dynamometer beam in such a way that the least amount of tension or weight unbalances its field. This is transmitted so that the repeater stations duplicate with an accuracy of less than 1½% any deflections of the master transmitter..... (527)

Temperature and Pressure Controller

C. J. Tagliabue Div., Portable Products Corp.
599 Park Ave., Brooklyn 5, N. Y.

A notable addition to the company's line of indicating, recording and controlling instruments, this automatic recorder-controller for temperature and pressure is said to control processing completely by the push of a button.

An adjustable cam starts timing automatically when the temperature reaches the processing point, and stops at the desired time. All valves are opened and closed automatically as the process may require.

During the steam-heating phase of the process, a red light appears on the controller. This is replaced by a white light when heating has been completed and steam shut off. The white light goes out when sufficient time for cooling has elapsed, thus indicating completion of the cycle..... (528)

FROM BLUEPRINT TO PRODUCT IN PLASTICS BY FELSENTHAL . . . FROM BLUEPRINT TO PRODUCT IN PLASTICS BY FELSENTHAL

PLASTIC HANDLES
INJECTION MOLDED by FELSENTHAL

EASY TO "DREAM UP" . . . BUT HARD TO PRODUCE

Volume production of this portable radio handle was considered a practical impossibility when it was handed to our engineers. It was a special design that posed two exceedingly difficult problems: (A) To make a 2-piece hollow handle that looked and felt like a solid grip. (B) To form the two component pieces so they could be rapidly and permanently interlocked.

We overcame these problems, and turned the "dream" into a brilliant plastic reality —by INJECTION MOLDING. If you have a similar "dream," submit it to our Design and Engineering Department. We are fully equipped to injection mold and assemble pieces up to 18 oz., requiring extreme pressures, widely varying thicknesses and unusual sizes and shapes—we can and will produce to your specifications, just as we have manufactured the hundreds of products shown in our Booklet No. 3-A. Ask for it on your letterhead.

ARMY NAVY

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G. FELSENTHAL & SONS
4124 W. GRAND AVE. CHICAGO 51, ILL.
BRANCH OFFICES: NEW YORK • DETROIT
Est. 1899

Literature Review

Synthetics in Electrical Field

Celanese Plastics Corporation
180 Madison Ave., New York 16, N. Y.

Outlining the various Celanese synthetics such as plastics, textiles, and chemicals, this recently published, well-prepared booklet lists their characteristics, mechanical and electrical properties, and some of their applications in the electrical field.

An unusual index describes each of the materials listed, and tells how they are applied.....(529)

Plasticized Polyvinyl Chloride

The B. F. Goodrich Company
500 S. Main St., Akron 18, Ohio

A short history of the development of *Koroseal*, a plasticized polyvinyl chloride, its resistance to various elements, and its mechanical properties and physical aspects, are described in an attractive and comprehensive 18-page booklet entitled "Koroseal, The Modern Flexible Material for Industry."

Numerous industrial and consumer uses are listed, and the entire booklet is beautifully illustrated.....(530)

Thermostat and Pressure Switches

United Electric Controls Company
69-71 A St., Boston 27, Mass.

Recently-published descriptive catalog gives complete information and engineering details on the entire line of thermostats and pressure switches produced by this company. Detailed diagrams showing switch action make this a valuable booklet of its kind. A listing of parts, temperature data, electrical loads and maximum pressures for the various models are also included .....(531)

Testing Machines Catalog

Tinius Olsen Testing Machine Co.
599-H N. 12th St., Philadelphia 23, Pa.

Catalog 30, which covers the company's entire line of testing machines for tension, compression, and flexure testing, also includes a full description of its pendulum lever weighing system, hydraulic and electro-mechanical loading systems, testing ranges, and specification details on machines in ranges from 1,000 to 1,000,000 or more lb.

In addition, this 56-page catalog includes descriptions of the "*L*" type and *Lo-Cap* machines, as well as the high-magnification recorder, proving rings, and accessory tools.....(532)

Veneer and Plywood Machinery

The Plycor Company
154 E. Erie St., Chicago 11, Ill.

A pictorially illustrated booklet describes in detail the frame press and the strain rod press—two basic designs of Plycor Hydraulic Hot-Plate Presses which are used for the production of resin-glued plywood. Plycor hydraulic pump units are also described .....(533)

G-E Mycalex

General Electric Co., Chemical Dept.
1 Plastics Ave., Pittsfield, Mass.

A new 24-page booklet describes in detail the technical and manufacturing data compiled by this company in its 23 years of *Mycalex* production; and lists properties, types available, molded and fabricated parts, machining practice, how and where to order the material.

A short history of its development is given, and certain characteristics are compared with those of other types of materials. Various design considerations in molding, fabricating and machining parts are discussed.

A properties chart of six grades of *Mycalex*, of both the compression and injection molded types, is an important feature of the booklet .....(534)

You and your Plastic Molder—

—an Enduring Relationship

Your choice of a molder is important for two reasons—it is important because the future of your plastic piece is in his hands, and it is important because, given reasonably good service, you will probably continue to use that molder for years. We therefore suggest that you make your choice with great care, and we'd like this organization to be included in those you consider.

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North Olden at Sixth
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NEW YORK OFFICE—1182 BROADWAY
Plastics PHENOLIC • UREA • CELLULOSE ACETATE MATERIALS

Let your HEAD take you

(The average American today has a choice of just going where "his feet take him", or choosing wisely the course to follow. Let's skip ahead 10 years, and take a look at John Jones—and listen to him . . .)

"SOMETIMES I feel so good it almost scares me.

"This house—I wouldn't swap a shingle off its roof for any other house on earth. This little valley, with the pond down in the hollow at the back, is the spot I like best in all the world.

"And they're mine. I own 'em. Nobody can take 'em away from me.

"I've got a little money coming in, regularly. Not much—but enough. And I tell you, when you can go to bed every night with nothing on your mind except the fun you're going to have tomorrow—that's as near Heaven as man gets on this earth!

"It wasn't always so.

"Back in '46—that was right after the war and sometimes the going wasn't too easy—I needed cash. Taxes were tough, and then Ellen got sick. Like almost everybody else, I was buying Bonds through the Payroll Plan—and I figured on cashing some of them in. But sick as she was, it was Ellen who talked me out of it.

" 'Don't do it, John!' she said. 'Please don't! For the first time in our lives, we're really saving money. It's wonderful to know that every single payday we have more money put aside! John, if we can only keep up this saving, think what it can mean! Maybe someday you won't have to work. Maybe we can own a home. And oh, how good it would feel to know that we need never worry about money when we're old!'

"Well, even after she got better, I stayed away from the weekly poker game—quit dropping a little cash at the hot spots now and then—gave up some of the things a man feels he has a right to. We didn't have as much fun for a while but we paid our taxes and the doctor and—we didn't touch the Bonds.

"What's more, we kept right on putting our extra cash into U. S. Savings Bonds. And the pay-off is making the world a pretty swell place today!"

The Treasury Department acknowledges with appreciation the publication of this advertisement by

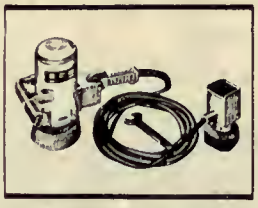
★ ZIFF-DAVIS PUBLISHING COMPANY ★

ZIFF-DAVIS PUBLISHING COMPANY

New Portable Grinder Lasts Longer ... Increases Production

The Portable Gaston Grinder is designed for the grinding and sanding of metal—also, with wire brushes, for paint and rust removal. Because it is powered by a 3-phase motor, without brushes, commutators or gears, the Gaston will give long service.

The Gaston Grinder starts at full speed. Its speed remains constant regardless of extra pressure by the operator. This controlled speed under heavy load, eliminates glazing of the grinding wheel; produces a better ground surface.



The Portable Gaston Grinder

Three sizes of dust-tight Gaston Grinders are available. Furnished in either "cup-wheel" or "edge-wheel" type, as desired.

In a dusty work atmosphere, that causes throat irritation and dryness, chewing Wrigley's Spearmint Gum helps keep workers' mouths moist and fresh—thereby reducing work interruptions—and "time out" to the drinking fountain.

Workers can stay at their machine, while chewing Wrigley's Spearmint—even when their hands are busy. There is no lost time. And the pleasant chewing helps keep them alert and wide-awake. One Connecticut manufacturer with a dust problem reports group production up about 3% over normal, when workers were given chewing gum. Other plants and factories everywhere, claim stepped-up efficiency when chewing gum is made available to all.

You can get complete information from William H. Howland, 2533 East 73rd Street, Chicago 49, Illinois

AA-69

Roll Leaf Hot Stamping Press

Peerless Roll Leaf Co., Inc.
4511-4523 New York Ave., Union City, N. J.

Light weight, rugged construction and easy operation are qualities attributed to the new Peerless *MW* roll leaf hot stamping press in a bulletin recently issued by the manufacturer.

Pictorial views show the press and its parts in both open and closed positions. Specifications of the new hand operated press are given, together with a partial list of products on which the press can be used. .....(535)

Production Information

Printloid, Inc.
95 Mercer St., New York 12, N. Y.

A highly informative and useful catalog, "Four Steps in Plastics Production," contains a glossary listing the main types of plastics materials, with trade-names, characteristics and typical applications of each. The processes performed by Printloid—forming, printing, die cutting, machining, designing and assembling—are described, with photographs showing the types of products produced .....(536)

Hot]Water Heating

Blaw-Knox Co., Power Piping Div.
1525 Pennsylvania Ave., Pittsburgh 12, Pa.

The Blaw-Knox *Supertherm System* of process heating, which uses superheated water, is ably described, and photographically illustrated, in a booklet issued by this company. This type of heating is said to lend itself particularly to the manufacture of molded plastics, rubber, textiles, ceramics, floor coverings, wall paper and chemicals.

Operation of the system is described in detail, and its application and advantages to each industry listed.....(537)

Custom Fabrication

The Fabri-Form Co.
Byesville, Ohio

An attractive two-color folder titled "Custom Fabrication in Plastics" briefly describes the processes involved in the company's method of fabricating acrylic sheets, rods and tubes, and laminated phenolics, as well as details of its engineering service offered in connection with its production facilities .....(538)

High Heat Resistant Coatings

The Dampney Company of America
Department T109
Hyde Park, Boston 36, Mass.

Thur-Ma-Lox coatings, which protect metal surfaces in power and process equipment against temperature damage from subzero to extreme high heat, are described in a new 4-page comprehensive bulletin issued by the manufacturer.

Typical applications of *No. 7* (black), effective on weather-exposed or sheltered metal surfaces subjected to temperatures up to 1600° F; and *No. 10*, effective on sheltered metal surfaces subjected to temperatures up to 1200° F, where an aluminum finish is desired, are given. Data sheets are also included..(539)

Dielectric Heating in Industry

Thermatron Div., Radio Receptor Co., Inc.
215 W. 19 St., New York 11, N. Y.

Bulletin *No. 7005*, issued by the company, outlines in some detail the principles of electronic heating, and cites typical applications for use of this process. This booklet also contains descriptions of various *Thermatron* models, indicating their respective uses.

File-size, the booklet is designed for quick and easy reading, and is compactly arranged to facilitate ready reference to the information contained in its 8 pages .....(540)

Quick and Accurate Drilling

Barco Machine Products Co.
1975 E. 65 St., Cleveland 3, O.

This recently-issued circular supplies important details and lists a few of the uses of *Micro-King Mill-Drill*, latest addition to the company's line of *Barco* Accuracy Equipment.

Said to cut quickly, cleanly, without burrs and with a freedom from breakage, and to be usable, with success, on all types of plastics, metal, and various other materials, this new *Barco* tool is described in brief in the circular .....(541)

ENGINEERING — News Letter —

By LEWIS WINNER
Market Research Engineer

Unique Die Method

Drastic shortages of equipment, materials and skilled labor, due to the urgent needs of wartime, created a variety of problems. These problems, particularly acute in industries which, like the plastics industry, are largely dependent upon steel dies, machine tools and skilled personnel, were in many cases successfully solved.

This was especially notable in the plastics field, where one such solution, devised by Enrique G. Touceda of the United States Navy, provided for the use of copper-beryllium as a die material for injection molding. This unique process introduced a procedure which will probably be adopted by many in the industry. Because of the high thermal conductivity of copper, it was possible to obtain more rapid heating and cooling than had been previously available with steel dies or those made from pressed metallic powders.

Higher Temperatures Possible

Application of higher degrees of heat are also possible with this new development. In methods formerly employed, it had been impossible to use segmental dies for injection purposes because the injection temperatures required were in excess of 200° F. In this new method, the dies may be assembled in segments and the entire assembly used at higher temperatures.

The copper-beryllium employed has a hardness of about B77 Rockwell. The copper is softened by heating to about 1500° F and then quenching. This causes the hardness to drop to about B65 Rockwell, at which it is sufficiently soft to conform to any contour, under pressure.

The assembled mold segments and the casings are pressed in a hydraulic press at about 5000 psi, which permits sufficient flowage of the parts of the mold to close any voids at intersections, as well as to flow smoothly around all contours of the pattern. The entire assembly is heated for two hours at a temperature of from 550° to 600° F. The copper-beryllium segments are hardened by precipitation hardening, after which the mold is cooled, then opened and the pattern removed. The finished die is then ready for assembly into an injection molding machine.

Any alloy that can be softened and subsequently hardened at a low temperature, by precipitation, could be used in this process. At present, however, there doesn't seem to be an alloy that will meet these requirements. Duralumin comes closest to meeting the softening-hardening requirements, but even this alloy cannot be used at the extremely high temperatures required in this procedure.

Induction Heating

Few recent developments have found so many unusual plastics applications as has induction heating. In one project, for instance, it has been adopted to produce strain-free thermoplastic items.

Developed by Henry L. Cox of South Charleston, W. Va., the method has been applied to heat the metallic inserts or pins that hold the bristles in thermoplastic-head type toothbrushes.

In methods formerly used, mechanical forcing operations were employed to anchor the bristles into drilled or die-made cavities. This resulted in channels in the walls of the cavities and caused considerable localized strain, the strain being, in some instances, so intense that cracks formed, particularly at points where the metal insert pierced the thermoplastic. It was difficult to relieve the strain and seal the bristle-retaining insert without affecting the finish of the plastics, the bristles, or the brush itself. In addition, external heat did not completely seal any channels or cracks present around the metallic insert. Because of the comparatively low thermal conductivity of thermoplastics, the usual heat-strain-relieving processes were ineffective, but the induction heating procedure seems to solve this problem.

A frequency of from 20 to 10,000 cycles can be used in the in-

No 2
Lessons in PLASTICS
PRODUCT DESIGNS
For every product under the sun that can be molded in plastic, there is a better looking, more practical design.
It is the job of a highly competent, thoroughly experienced staff of Continental Plastics engineers to determine which of the design principles best fit your particular product.
This is the second of the five basic steps, necessary to turning out the perfect plastic result, in which Continental personnel qualifies far beyond the ordinary.
Before you select a definite design for your product, it will pay you to CONSULT CONTINENTAL PLASTICS CORPORATION.
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Armour Abrasives Help You Do Your Jobs Better

For better, faster finishing you'll need the fastest tools and the best abrasives possible.

In any operation . . . in removing flash and parting lines, in smoothing rough spots and mold defects—on any plastic . . . there are *specialized* ARMOUR ABRASIVES *designed* to do a *better job at less cost.* They are available in rolls, belts, discs, sheets and in special forms for special jobs.

It will pay you to call on Armour's experienced technicians. They will gladly help you choose the abrasives and methods which do your jobs best.

ARMOUR *Sandpaper* WORKS

DIVISION OF ARMOUR AND COMPANY
1355 West 31st Street, Chicago 9, Illinois

duction heating furnace. The intensity of the alternating magnetic field is adjusted so that the inserts are heated to a temperature of between 125° C and 160° C in about 25 sec.

A variety of thermoplastics have been used with this process. Compositions containing vinyl resins are preferred. Toothbrush heads made with vinyl resins and inductively heat-treated were found to have an extremely high Izod impact strength. In several tests the average energy required to break a vinyl resin head so treated was .217 ft lb. The average energy required to break a standard type head, not heat-treated, was .163 ft lb. Thus we have an increase of about 33% in the impact strength of the heat-treated head.

If the induction furnace is large enough, batches of brushes can be continuously passed through, since the induction furnace heats all of the metallic inserts effectively. Incidentally, the insert is heated to a temperature somewhat above the softening temperature of the thermoplastic material, in this way providing sealing of any channels, cracks, fissures, or similar defects in the plastics.

New Type of Welding

Thermoplastics welding, introduced during the war, will probably become quite a standard practice in many plants and shops. Mobile and fixed type units, developed for this kind of work. have many novel design improvements.

One device, developed by Wm. M. Phillips, Jr., Detroit, uses a jet or blast of combustible gas. Several types of gases have been used; hydrogen, acetylene, methane, or other hydrocarbon combustible gases, such as gasoline or oil. To support combustion, the preferred gas is oxygen or air.

In welding thermoplastics the materials must not be brought to charring temperatures. This new welder provides control of the hot gaseous blast and thus avoids charring.

Various Types Used

Included among the thermoplastics that have been welded with this torch are: copolymer of vinylidene chloride and vinyl chloride; polymerized vinyl chloride; and copolymer of vinyl chloride and vinyl acetate.

To avoid charring, the burning gases are diluted in a combustion chamber, either by an inert gas such as carbon dioxide, helium or nitrogen, or by an excess of gas which supports combustion. By diluting the hot products of combustion to the necessary temperatures, it is possible to obtain the required velocity of heated gas. In regulating the heat output of the torch and arriving at a suitable gas blast, it is necessary to determine the following: Melting point of the material being welded; heat absorption coefficient of the thermoplastic; heat conductivity; temperature and velocity of the gas blast.

Shipping Problem Solved

Powdered mineral pitch (often used as a base for paints) which dried to a plastics-like surface, usually faced a shipping problem because of caking and coalescence. Even when the pitch was mixed with a solvent the problem would exist, the pitch caking in the bottom of the container in which it was stored.

William Zaisser, Woodside, N. Y., has overcome this difficulty by mixing the mineral pitch with a filler material such as asbestos.

A typical non-caking composition consists of one to seven parts, by volume, of a pulverized mineral pitch (asphalt distilled by steam heat, hot air or direct heat); one to two parts of a pulverized barrier material, such as coal tar pitch or uintaite; and the filler material. Before use, this composition is mixed with a solvent, such as petroleum oil. When applied, the solvent evaporates and the composition hardens.

Pulverizing Necessary

As coal tar pitch and natural asphalts are brittle, it is necessary to pulverize these ingredients. This is done by, mixing one part limestone, two parts natural asphalt, and one-half to one part No. 5 fuel oil. Kerosene may also be used as a solvent.

These pitch compositions brushed onto paper toweling and textile fabrics have produced flexible, leather-like finishes.

The pulverized uintaite and natural asphalts used for this process had a melting point as high as 300° F, while the pulverized coal tar pitch had a melting point of from 250° to 300° F. END

INDUSTRY HIGHLIGHTS

Marked reduction of production time formerly required for a number of heavy duty plastics products is promised by G-E officials as a result of the new semi-automatic preforming press developed by engineers of the General Electric Co. at Pittsfield, Mass.

It is stated that the new press will permit the preforming of high bulk phenolic materials, previously preformed by hand, into units weighing as much as 1 lb. It allows dielectric preheating of the material and is accordingly slated to reduce the molding cycle considerably on all applications.

Change of company name has been announced by the Electroforming Co., Hartland, Wis., which is henceforth to be known as Hartland Plastics, Inc.

Included in the exhibit of United States Rubber Co. at the SPI National Plastics Exposition in New York was the company's new textile treating resin, *Kandar*. Said to impart a permanent crispness to cotton fabrics, thereby eliminating the necessity for starch in their laundering, the *Kandar* treatment is applied at time of manufacture. The company's new contact resin for laminating with glass or textile fabrics at low temperature and pressure was also on exhibit. Known as *Vibrin*, this resin was developed to meet a wartime requirement. Also shown was a strippable, protective plastics coating, called *Kotol*.

Information has recently been released on the development at Massachusetts Institute of Technology, during the war, of low thermal expansion plastics which can match the thermal expansion of metals and can be used with them. *Polyglas*, a molding powder composed of grains of specially prepared glass coated with a layer of polystyrene or poly-dichlorostyrene, was used to reduce the coefficient of expansion of the plastics to the desired value.

This thermoplastic material was developed at the request of the Bureau of Ships for use in a solid rotary joint for radar antennae in which a plastics was needed to match the thermal coefficient of copper and brass. Other *Polyglas* combinations have since been developed to meet additional requirements as to mechanical strength, high arc resistance, greater temperature stability, and prescribed values of the dielectric constant.

Opening of a sales office in Seattle has recently been announced by Interlake Chemical Corp., Cleveland. The new office, established primarily to serve such industries as those of plywood, wood pulp and paper, is in charge of John J. Bogner.

A new protective coating for metal, wood, glass, and fabrics, with an oil-resistant, synthetic rubber and plastics base, has been announced by the Cray Corp., Pasadena, Calif. Known as *Vulcabond*, it is described as a rapid-drying compound which can be applied with brush, spray gun or by dipping and which, when dry, is impervious to many of the destructive agents which attack paints. Claims for the product state that in tests under direct flame up to 400° F for short periods of time, *Vulcabond* did not blister, char, or peel, and that long exposure to direct sunlight failed to produce apparent change in its physical characteristics.

Establishment of a new *Tenite* sales office in Rochester, N. Y., for provision of more concentrated and effective service

CIBANITE

A

SPECIALIZED PLASTIC

FOR INDUSTRIAL AND

ELECTRICAL USES

ANILINE FORMALDEHYDE RESIN

•

THERMOPLASTIC MOLDING POWDER

HIGH DIELECTRIC VALUE
HIGH TENSILE STRENGTH - LOW LOSS FACTOR
LOW WATER ABSORPTION
EXCEPTIONAL ELECTRIC STABILITY
GOOD MACHINING PROPERTIES

Literature available on request

CIBA PRODUCTS CORP., 77 River St., Hoboken, N. J.

to customers in the northern New York and Pennsylvania areas, has been announced by Tennessee Eastman Corp. Eugene C. Cathcart is in charge of the new office, which is at 343 State St.

This territory was formely covered out of the Buffalo office, which has been discontinued, Nelce C. Taylor, recently in charge of that office, having resumed the activity of service engineer, headquartering in Cleveland.

Also announced is the establishment of a new *Tenite* sales office for the benefit of Canadian customers, at 57 Bloor St., West, Toronto, Ont., in charge of Robert R. Moore. This area was formerly handled through the company's offices in Buffalo and in Leominster, Mass.

Full scale production of the first of a series of its *Darex* copolymers has been attained, says a report from the Organic Chemicals Division of Dewey & Almy Chemical Co. Facilities now available at Cambridge, Mass., are producing *Darex Copolymers 2* and *3*, and more space is available, with additional equipment for resin and synthetic rubber production being installed at Acton, Mass. Described as efficient processing aids and compounding ingredients, a variety of uses have been forecast for these products.

Planned by Cluett, Peabody & Co., Inc., is an intensified and expanded scientific research program, upon completion of the company's new research laboratory. In announcing the project at the recent, annual meeting of the company, C. R. Palmer, president, stated that the program, under direction of research director E. C. Pfeffer, Jr., would be conducted along broad general lines including research in the fields of textiles and textile finishes, non-woven fabrics, chemical and mechanical process research, improvements in plastics and developments of new synthetic fibres.

Following reconversion from the wartime production of paper containers, manufacture of inexpensive plastics products has been started at a plant of Cleveland Container Co. in Ogdensburg, N. Y., supplementing manufacture of plastics products at its Plymouth, Wis., plant.

While production at present is limited to small toys of plastics, it is reported that the Ogdensburg plant is to become the center for design, technical and sales functions of the company.

Most of the machine work for the new factory has been done by the Container Corp. at the up-to-date foundry which it owns and operates in upper New York State. Gerald W. Mulder has been made general manager of the company's interests in Ogdensburg, including a plant which is still producing paper containers, as well as the newly-reconverted factory.

Announcing the move to a more central location as part of the company's extensive program of expansion, the E. W. Bliss Co., of Brooklyn, has transferred its executive offices to Detroit, at 450 Amsterdam St. The Bliss manufacturing division in Brooklyn is to be maintained, as well as its plants in other cities.

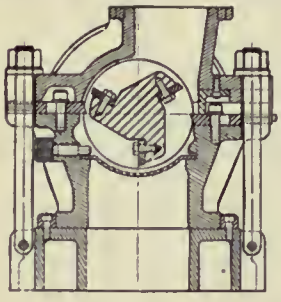
Volume production of a melamine-formaldehyde resin solution developed during the war, but never before produced in commercial quantities, has been begun by Monsanto Chemical Co.'s plastics division, Indian Orchard. Known as *Resimene 875*, the product is designed for use in surface-coating applications in industries such as automotive and household appliances, where it is claimed that it cuts baking cycle to one or two minutes, improves properties of hardness, color retention, and resistance of the coating to alkalis, solvents, and abrasion. Several applications were shown at the recent SPI Plastics Exposition.

A. W. Dunning has been appointed assistant sales manager in charge of surface-coating resins, while Jack Lurie will handle technical service activities.

New construction is under way at the Indian Orchard division as part of Monsanto's vast postwar expansion program, according to Carl T. King, production manager.

Removal to its new plant and offices on Fairhill Ave., west of Tyson, Glenside, Pa., has been announced by Penn-Plastics Corp.

Cumberland Plastics Granulating Machines



Compact cutting chamber provides a new degree of "INTENSIVE CUTTING"

Designed expressly for granulating plastic materials, Cumberland Plastics Granulating Machines provide exactly the type of "intensive" cutting needed for tough plastic materials. Compact cutting chamber; short, rugged knives; small cutting circle—these and numerous other features combine to give Cumberland Machines superior performance. Made in 4 sizes; No. ½ machine illustrated at right.

SEND for fully illustrated CATALOG No. 200

CUMBERLAND ENGINEERING CO.

Dept. B—Box 216, Providence, R. I.

PEOPLE

Harold J. Cook has been appointed controller of Chemaco Corp., Berkeley Heights, N. J., after having been associated for the past two years as plant auditor with Manufacturers Chemical Corp., of which Chemaco Corp. is a subsidiary.

* * *

Stuart O. Fiedler, research associate, has been appointed manager of the South Chicago branch of Bjorksten Laboratories.

* * *

Dr. William H. Aiken, former captain in the U. S. Army Quartermaster Corps, has been appointed assistant manager of the plastics and coatings department of the Goodyear Tire & Rubber Company's newly-organized Chemical Products Division.

* * *

The DoAll Co., Minneapolis, and Des Plaines, Ill., has announced the appointment of **L. R. Rothenberger** to the position of general sales manager.

Dr. W. H. Aiken

L. R. Rothenberger

F. F. McKinney

Frank F. McKinney has returned from the U. S. Army to resume his work with the Quaker Oats Co., Chicago, where he will have supervision of technical sales of the company's recently-formed Chemicals Dept.

* * *

James T. Skelly, Jr., has been made assistant director of sales of the cellulose products department of Hercules Powder Co.

* * *

Dr. Paul O. Powers has recently been named to the staff of Batelle Memorial Institute, where he will aid in research on plastics, organic coatings, plasticizers, resins, and other phases of synthetic chemistry of importance to peace-time industry.

* * *

The Bristol Co., Waterbury, Conn., has advised of the appointment of **H. A. Van Hala** as district manager of the company's Cleveland office, and **Charles Webber** as managing director of The Bristol Co. of Canada, Ltd.

* * *

P. J. Ryan, formerly vice president in charge of production for Reichold Chemicals, Inc., has become vice president in charge of the company's southern division, with headquarters in Tuscaloosa, Ala.

* * *

Recent additions to the staff of Polamold Research Laboratories, Inc., Springfield, O., include **Everett Arnoult, L. L. Teel, and Charles Boegli.**

* * *

Dr. R. W. Harris, vice president and director of Heyden Chemical Corp., has been elected president of American Plastics Corp.

* * *

Mario J. Petretti has been appointed general manager of Noma Electric Corp.'s plastics and capacitors divisions in Holyoke, Mass.

* * *

Walter J. Dreves has become director of finance, and controller, of International Plastic Corp., Morristown, N. J.

* * *

John M. Sherrer has joined Barnes & Reinecke, Chicago

Specialties

Cold-forged at a saving

If you need o special rivet, noil or threaded port—ond soon—we con make it for you. Cold-forging offers you not only surprisingly quick delivery, but a substontiol soving as well.

Steel, Stoinless Steel, Monel, Brass, Copper, Bronze, Aluminum ond Aluminum Alloys ore everyday materiols to us. A voried stock of sizes and metols is ovoilable to serve you.

Both economy of monufocture ond strength of product are obtoinoble by using cold-heoded ports. Send us o sketch or somple of your part. No obligotion. Ask for free cotolog.

JOHN HASSALL, INC.

160 CLAY STREET
BROOKLYN 22, N. Y.

SPECIAL NAILS RIVETS SCREWS
Hassall

Special nails, rivets, screws and threaded parts

For every purpose--

TO YOUR SPECIFICATIONS

For over forty years we have been leaders in the design and manufacture of component parts for leading Refrigerator, Stove, Furniture, Appliance and Cabinet industries. We specialize in custom molding by the injection, compression or transfer method in any thermosetting or thermoplastic material. A complete service from one source to serve your needs — at no extra cost.

RESEARCH — Highly experienced research engineers to determine the material best suited for your needs as to strength, utility and beauty.

DESIGN — A thorough study is made as to the utility, shape and color of the plastic part that will best harmonize with the style and design of your product.

ENGINEERING— Here is where the correct tools, precision dies and molds are developed to produce the best job, efficiently and economically.

TOOL AND MOLD MAKING — This department, manned by expert craftsmen, makes the necessary tools and molds to produce the finished product.

MOLDING — A complete department equipped with the latest and most modern presses and molding equipment — for Injection, Compression or Transfer molding.

INSPECTION AND SHIPPING Each individual piece is carefully inspected for uniformity, color and finish. All parts are carefully wrapped and packed for utmost protection.

If you are planning the use of plastic parts in your products, it will be advantageous for you to investigate our complete service. Write or phone us about your needs.

NATIONAL LOCK COMPANY
Plastics Division
ROCKFORD, ILLINOIS

designers and engineers, as design consultant on plastics products and various equipment.

* * *

George H. Day, II, sales manager of the *Lumite* division of Chicopee Mfg. Corp., has announced the appointment of **Ward S. Cook** as representative for *Lumite* screen cloth in Chicago and eleven midwestern states.

* * *

Steiner-Mfg. Co., Brooklyn, has announced that **Donald M. White** has joined the organization in the capacity of designer of fixtures and other items for display, featured by the company.

* * *

John Brooke Gregory has become a member of the staff of the Frederick S. Bacon chemical research laboratories, Watertown, Mass.

* * *

Wales-Strippit Corp. has announced the appointment of **Harold L. Adamson** as factory representative in the San Francisco area.

* * *

Formerly head of *Tenite* sales with Wilson & George Meyer & Co., Los Angeles, **Bert L. Murman** has assumed the presidency of Plastic Molded Products, Inc., of the same city.

B. L. Murman

H. M. Parkesian

G. E. Vybiral

Harold M. Parkesian, formerly of Binney & Smith Co., has been appointed director of sales and technical service of The Glenn L. Martin Co.'s plastics and chemicals division, Baltimore. He will be in charge of the sale of *Marvinol* polyvinyl resins and related products.

* * *

George E. Vybiral has been named assistant chief engineer of the *Panelyte* division, St. Regis Paper Co. **W. E. Caldwell** has recently become chief engineer, succeeding **R. W. Barber** who has been made assistant plant manager.

* * *

William B. Nichols, president of Plastic Film Corp., New York, has announced the appointment of **Laurence R. Sherman** as general sales manager.

* * *

Joseph Young has recently announced his resignation from the sales managership of the Adhesives Division of Arvey Corp., Jersey City, to open his own offices at 521 Fifth Ave., N. Y., as a consultant on sales promotion, merchandising, and packaging; he will specialize in plastics, foils, films, laminating and allied fields.

* * *

Dr. Steuart E. Tray, chemical engineer, has become assistant manager of the basic industries department in charge of the new chemical processing machinery section at Allis-Chalmers Mfg. Co., Milwaukee.

* * *

Recently announced by Victory Mfg. Co., Chicago, is the addition of **M. Gurrie,** formerly associated with Stewart-Warner Corp., to the company's staff as assistant to Edward Singer, president.

* * *

Harold L. Aldrich has been appointed district representative in the New York office of General Electric Chemical Dept., and will be sales representative for the company's *Glyptal* alkyd resins.

* * *

W. W. Scull has been made production manager of plants of B. F. Goodrich Chemical Co.

plastics overseas

Magnitude of Industry

BRITAIN'S plastics industry nowadays employs over 50,000 workers and disposes over a bigger production tonnage and capital investment than is generally realized outside of the country. In addition, the war years have increased the range of readily available materials and reduced their prices as well as having improved the industry's overall manufacturing efficiency.

Nevertheless, the return to normal trading conditions, together with the rapid falling off in profitable war orders, are putting this industry at present to the crucial test of providing proof of its commercial ability to compete in the commodity markets against other industries based on more traditional raw materials.

And the British plastics industry—finding its plant conversion and labor problems less difficult and cumbersome than those of almost any other branch of industry—is meeting this challenge outright by supplying an ever-growing stream of economically competitive new products.

Household Commodities

There is tangible evidence of this, especially in the wide range of new plastics household and home commodities designed to ease the plight of the harassed British housewife.

In particular, items for her kitchen are planned on an almost lavish scale, and British manufacturers are now busily turning out plastics items varying from refrigerators and kitchen tables to dustbins, tablecloths and cooking utensils.

A polyvinyl chloride plastics is being used extensively for non-slip, durable floor coverings, in place of linoleum; another, in the thermoplastic group, is helping to overcome the acute shortage of jute for backing carpets.

Washable and resistant to dampness and heat, plastics-coated nylon and rayon fabrics are now being produced (although at present bottle-necked by the textile industry's lack of spun yarn) for furniture coverings, curtains and upholstery.

Good-sized, soft and pliant plastics sponges, usable with soap without becoming clammy, are now available in large quantities in shops and stores at prices comparing favorably with those of ordinary sponges.

Sundry Applications

Numerous other uses for plastics are also becoming apparent. For example, plastics stereos, a novelty in Britain only a couple of years ago, are now well established and regarded as the speediest and most reliable medium for overseas printing. In fact, enormous quantities of light-weight plastics commercial advertising plates are now daily sent by air-mail from England to all parts of the world.

The display possibilities of plastics are also being evidenced, and such use is increasing rapidly despite the comparatively high cost involved.

Many types of clear and colored plastics materials are being experimented with and are demonstrating their display value.

Toymaking

Britain's toymakers are currently exporting immense quantities of mass-produced plastics toys to her dominions and colonies, where "better class" plastics dolls seem to be especially popular and more sought after than those made of wood or other materials.

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NEW ENGLAND—Wm. T. Wyler, 177 State St., Bridgeport, Conn.

Plastics Games Ltd., a recently-formed London toy company, has announced its intention of making plastics model toy theaters part of every child's collection of playthings.

Claiming that they can be mass-produced from plastics at much lower cost than that of making them from wood or other materials, this company plans an annual output of a million of these toys for both the home market and export, selling at prices well within the reach of every mother's purse.

Plastics Pipes

The enormous shortage of supplies of tobacco pipes due to the lack of briar wood and other materials normally used in the manufacture of pipes has caused an increasing stream of plastics pipes to find their way to British tobacconists and stores.

As good as ordinary pipes and sold at very reasonable prices, these pipes are indistinguishable in appearance and taste from those made from the traditional raw material.

Projector, Recording Tape

A novel, 35-mm perforated film strip projector for use in schools and colleges is now being marketed in Britain.

Designed by Richard Lonsdale-Hands, English industrial designer, and manufactured by British Acoustic Ltd., this unit is completely housed in plastics; wood-filled phenolic base is used for lamp cover, clamping knobs, film carrier base and bottom cover, black cellulose acetate for the film winder, and clear polysterene for container and lid.

A high-fidelity plastics sound-recording tape, originally invented by I. G. Farben experts and used throughout the war by the Germans, is to be made available to British and American radio stations.

This tape is part of a new sound-recording system known as the *Magnetophone*, differing from ordinary disc, wire or tape recording systems by dispensing with needles and the cutting of tracks.

The tape itself is about 1 cm wide and embedded with fine metal granules agitated by sound vibrations and "paraded" with the aid of a special magnetic device in a manner which is similar to that of the sound track of a film.

A record made by this method is permanent and can be played back immediately without processing, or wiped off without difficulty, and re-used.

Typewriters

According to a German report, two Bavarian typewriter manufacturing concerns, faced with an acute shortage of metal component parts, recently pooled resources with a plastics company and started production of all-plastics typewriters.

Claiming that their machines are trustworthy and able to withstand the strains of normal usage, the makers are marketing these plastics typewriters at comparatively low prices.

Plastics Underseas

Professor Auguste Piccard, the Belgian scientist who at one time ascended 10 miles in a balloon to explore the stratosphere, has now announced his intention of descending 2½ miles (12,000 ft) in the Atlantic Ocean, to film its hidden secrets.

For this journey, Piccard has designed an 8" thick, steel-walled, spherical submarine fitted with two enormous conical-shaped methyl methacrylate windows which can withstand a pressure of 12,000 psi.

Historical Importance

In an address delivered to the British Royal Society of Arts, Sir Frank Smith, Anglo-Iranian oil expert, recently summed up the development of plastics throughout the ages as follows:

"The oldest type of plastics material is bitumen, a petroleum polymer. It was used by Noah in the building of the Ark and again by Nebuchadnezzar in the building of the great wall of Babylon.

"Today, bitumen has descended from its royal splendor, and is used in a much more lowly way by being mixed with silica and similar materials, for the manufacture of black stoppers for beer bottles." END

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association activities

Presses Discussed at Chicago SPE Meeting

Featured speakers at the May 3 dinner meeting of the Chicago section of the Society of Plastics Engineers were M. V. Kemper, Improved Paper Machinery Corp.; Dale Theobald, manager, plastics machinery division of Van Dorn Iron Works; and Frank Newkirk, N-R-K Manufacturing & Engineering Co. Mr. Kemper's talk was on the subject of "Vertical Clamping, Side Injection Presses and Trends," during which he described operation of the new-type press recently introduced by Improved Paper Machinery Corp.

Speaking on the topic of midget molding machines, Mr. Theobald displayed a new 1-oz power-operated injection press, explaining its operation and advantages. Mr. Newkirk, whose speech also dealt with diminutive molding equipment, was introduced as the engineer who invented the Plasticor "educational molding machine." He related the history of the development of this unit, and demonstrated its use.

Symposium on Copolymers

Recent experimental studies on copolymerization carried out at Brooklyn Polytechnic Institute were reported by Turner Alfrey, Jr., at the spring meeting of the American Chemical Society, in Atlantic City. His report was one paper of a symposium on the physical chemistry of copolymers and copolymerization, during which the concept of "partial conversion properties" was

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introduced by Frederick T. Wall, University of Urbana, who defined the term as "the value of a property which can be associated with the polymer forming at any instant during the conversion" (from monomers).

A study of the copolymerization of vinyl compounds with dienes was presented by A. Goldberg, T. Alfrey and W. P. Hohenstein, while an equation to measure the distribution of compositions in a copolymer was the subject of a paper by Irving Skeist, Celanese Corp. of America.

New Group Plans Technical Convention

Extensive plans, well under way, for a technical convention to be held in October by The American Society of Body Engineers, Inc., at the Rackham Memorial Bldg., Detroit, have been announced by Carl W. Cenzer, general chairman of the convention.

The society, recently organized as a non-profit corporation, is composed entirely of leading body engineers from practically all of the companies in the automotive industry, according to announcement. I. Louis Carron, body engineer of the Detroit Harvester Co., is president of this newly-formed group, which has established its national headquarters in the Rackham Memorial Bldg.

Laminates Topic at Newark SPE Meetings

The steadily increasing interest in laminates formed the basis for the programs of both the April and the May dinner-meetings of the Newark section, Society of Plastics Engineers. Robert Metzler, Hercules Powder Co., was featured speaker at the April meeting, where he delivered an illustrated talk on the subject of "Thermoplastic Laminates Based on Cellulosics and Derivatives." He maintained that the qualities of these newly-developed thermoplastic laminates compare favorably with those of thermosetting laminates, and his audience displayed particular interest in examples of deep draws obtained on cold dies.

The May 7 meeting had for its speaker Perry Wilson, Bakelite Corp., who discussed the subject of low pressure molded laminates. As an additional highlight of the evening, there was a showing of the motion picture, "Formica at Work," dealing with high pressure laminates.

ASTM Annual Meeting

Scheduled on the technical program for the 49th annual meeting of the American Society for Testing Materials are twenty-three formal technical sessions and more than two hundred meetings of the organization's technical committees.

This 1946 meeting is to be held at the Hotel Statler, Buffalo, N. Y., June 24 to 28, inclusive. At the same time, the society announces, the 7th exhibit of testing apparatus and related equipment will be in progress, and the annual photographic exhibit also will be held.

Textile Chemists & Colorists Hear Plastics Talks

The New York section of the American Association of Textile Chemists & Colorists, at a recent meeting, heard talks by R. E. Thomas, director of the Fabrikoid division, Newburgh Laboratory, E. I. du Pont de Nemours & Co.; M. R. Radcliffe, Firestone Industrial Products Co.; and Carl W. Patton, Bakelite Corp.

Speaking on the pitfalls possible in accelerated tests, Mr. Thomas said that such tests were merely guides to be verified by actual service. Mr. Radcliffe's address dealt with plastics monofilament yarns and future aspects of vinyls and polyethylene in this field. "Unsupported Films and Sheetings" formed the subject of Mr. Patton's talk.

Crowds at ASTE Exposition

Attendance at the ASTE Exposition in Cleveland, April 8 to 12, was reported as having exceeded the most optimistic estimates, which was felt by officials of the organization to be particularly noteworthy in view of the fact that attendance was restricted to industry and by invitation. Described as the largest collection of diversified manufacturing equipment ever assembled under one roof, the show had for its theme, throughout, the "production of goods at lower costs while industry is meeting higher wages." This theme was carried through in the nine ASTE technical sessions held concurrently with the Exposition.

Statistical Data

LAST month, when statistics compiled by the Industry Division of the Bureau of the Census, Department of Commerce, on plastics and synthetic resins shipments and consumption were presented for the first time in these pages, figures were given for November and December, 1945. The December figure, about 1,500,000 lb lower than that for November (which was in turn below the October figure), was in line with an apparent dropping off of production after V-J Day.

The total for January, as shown below, indicates a sharp increase above the total for December (41,539,277 lb). Although there was a slight drop in the total for February, actually the daily average was greater than for January because of fewer days in the month.

On the basis of the November to February figures, it is reasonable to expect an increase in March. The upward trend seems to indicate that the materials suppliers have overcome the worst obstacles to reconversion, although they are still not up to the 1944 and early 1945 rates of production.

Among the most interesting individual developments is the steady increase from November to February in consumption and shipments for vinyl sheeting and film and for polystyrene. The increase for polystyrene substantiates a statement of W. Stuart Landes in his speech at the Annual SPI Conference on the materials situation: "There are a few bright spots. Polystyrene is coming to the rescue and will be one of the first plastics to appear in the form of sizable increases."

The statistics below represent the shipments and consumption of plastics and synthetic resins as reported by 77 manufacturing companies and company departments. Data for synthetic resins for protective coatings are not included. Shipments, for the purposes of this report, include data for plastics and resins manufactured by the reporting companies or company divisions and shipped to outside users. Consumption refers to the quantities of plastics and resins manufactured and used by the reporting companies or company divisions.

Plastics and Synthetic Resins Shipments and Consumption (lb.)

Item	February 1946	January 1946
Cellulose acetate and mixed ester plastics[1]		
Sheets		
Continuous (under .003 gouge)	596,355	591,872
Continuous (.003 gouge and upward)	541,542	524,883
All other sheets, rods, and tubes	410,867	447,364
Molding and extrusion materials	6,024,690	6,689,778
Nitrocellulose plastics[1]		
Sheets	822,120	905,696
Rods and tubes	613,116	608,576
Phenolic and other tar acid resins		
Laminating (dry basis)	1,806,919	2,298,813
Adhesives (dry basis)	991,233	1,070,902
Molding materials[1]	10,606,487	10,739,472
All other (dry basis)[2]	4,331,994	4,413,038
Urea and melamine resins		
Adhesives (dry basis)	2,794,506	2,650,044
Textile and paper treating (dry basis)	995,776	1,071,084
All other (dry basis)[2]	167,559	235,687
Polystyrene	3,007,122	2,727,579
Vinyl resins		
Sheeting and film[1]	1,665,666	1,569,044
Textile and paper coating resins (resin content)	1,034,511	1,650,026
Molding and extrusion materials[1]	5,910,429	5,496,024
Adhesives (resin content)	399,600	399,177
All other (resin content)[2]	589,224	352,250
Miscellaneous plastics and resins		
Molding and extrusion materials[1,3]	4,498,719	4,647,572
All other (dry basis)[2,4]	2,612,440	2,630,148
TOTAL	50,420,875	51,719,029

[1]Includes fillers, plasticizers, and extenders. [2]Excludes data for protective coating resins. [3]Includes data for ethyl cellulose, urea and melamine, acrylic acid, and miscellaneous molding and extrusion materials. [4]Includes data for petroleum resins, acrylic acid ester resins, mixtures, and miscellaneous synthetic resin materials.

PROBLEMS in *plastics*

Problems and questions may be submitted to this department for answering by the technical editors or specialists in the industry.

Is there any method of cutting plastics film with an electric cutting machine, so that it will not stick together at the edges?
W.K., New York, N. Y.

It is suggested that you try using alternate layers of plastics film and paper to prevent the edges from sticking together.

* * *

We have been experimenting with various types of removable drain boards for use with double compartment sinks. We would like to explore the possibilities of plastics drain boards.
J.L.C., Detroit, Mich.

It is doubtful that any manufacturer would have a stock mold for forming sheet plastics that would be adaptable for your application.

There are several methods in which the molding of these boards may be accomplished. One method is by post-forming phenolic laminates. Another is by the molding of low density impregnated sheet plies. A third possibility of producing these parts is by a newly developed technique which uses resin-impregnated "Fiberglas."

We suggest you contact several laminators to find one who will be in a position to work with you.

* * *

Please suggest a sealing product which can be used as a coating on wood to prevent contained moisture from escaping.
A.A.H., Philadelphia, Pa.

Any good moisture-resistant plastics film, such as the vinyls, should be a satisfactory coating for your purpose.

* * *

We are desirous of either printing or stamping animations on an acetate motionizer used in the face of a clock which we manufacture. We are using a screen process at present, but would prefer a faster and more permanent system.
R.H.B., Indianapolis, Ind.

There is a roll-leaf stamping process which is comparatively fast and permanent, and which we think would probably be suitable for your purpose.

* * *

We are planning to manufacture a product which must have the characteristic of not completely submerging in water, and must have a low water absorption. What plastics material do you recommend that we use? L.E.S., Chicago, Ill.

Polyethylene has a specific gravity of about .9, and has an unusually low rate of water absorption. This plastics material should be ideal for your requirements.

* * *

Is it possible to extrude thermosetting resins? If so, where can I obtain information about the process?
V.E.G., Homewood, Ill.

While there has been some experimentation done on the extrusion of thermosetting plastics, as far as we know, this process has not yet been developed to the commercial stage.

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SPI Annual Conference

(Continued from page 57)

cal or effective impact resistance is either flexural work to break, notched, or flexural work to break, unnotched. These effective values become much lower as the notch becomes sharper, so try to avoid notches and their equivalents in molded objects."

Chas. J. Smith, Bryant Electric Co., "High Speed Plunger Molding of Phenolics": Smith claimed speeded-up operation, parts of uniform density, reduced cure time, fewer finishing operations, and reduced costs as advantages of high speed plunger molding.

The equipment consists principally of the press, the radio-frequency induction heating set, and the molds. The heating set is of the utmost importance. The press is a conventional molding press with an auxiliary cylinder attached to the head. This cylinder is used to apply pressure to a hardened steel plunger attached to the cylinder ram on the under side of the press head. (See Smith's article on plunger molding in the November, 1945, ***plastics.***)

Morris Sanders, Designer and Architect, "New and Proposed Applications in the Extrusion Field": Sanders traced the development of the field from its limited beginnings 15 years ago to the present. Extruders have learned, he said, "complementary trades and technics —the weaving of fine filaments and extruded fibers, the machining, bending, and forming of rigid stock." He illustrated his talk with slides showing various forms of extrusions used in furniture and with "blackboard ideas" of a variety of products from corkscrew holders to toys.

Nils G. Fischer, Industrial Engineer and Consultant, "Cost Factors in the Extrusion Molding Industry": Fischer reviewed the nature and uses of cost accounting generally, then went on to consider the specific problems of the extruder. Among the factors discussed were the control of raw material, the calculation of its cost, inventory shrinkage, labor costs, and "the most controversial subject in cost accounting"—overhead. He also indicated other problems requiring solution.

W. S. Landes, Celanese Corp. of America, President PMMA, "The Material Supply Situation": There will be no marked relief in the materials situation in 1946, in 1947 supply will probably be no greater than 75% of the demand, and it may take five years for supply to equal demand. This was the gist of Landes' talk, in which he said that the materials manufacturers understand the situation and are bending every effort to increase production. The numerous reasons for the inability of the manufacturers to meet current demands were discussed in considerable detail. The great increases during the war in molding and extruding capacity, when the materials manufacturers were stymied by inability to obtain government priorities for expanded capacities, was especially emphasized as a reason for the shortages.

Morris Yellin, "Potential Hazards in Customer-Molder Relations": Molder hazards and pitfalls, such as entering into contracts to furnish a molded object of a given type or made from a given plastics material without the proper exploratory testing, arise in part, at least, from the newness of plastics and the lack of accumulated experience and knowledge about them, Yellin said, and he advised the molder to protect himself against unforeseen risks by (1) obtaining a contract which offered protection against hidden pitfalls, or (2) refusing to accept an order involving danger of great loss.

Burton E. Cash, Celanese Corp. of America, "Field Performance of Forticel": See page 32.

Donald H. Reynolds, Machinery & Allied Products Institute, "The Case for De-Control of Machinery and Equipment in the Plastics Industry": In order to achieve high-volume low-cost production, which the experts agree is the way to prevent inflation, it is essential that new and more efficient machinery be made available. In that way rising production costs, of which labor costs are a major factor, will be offset by reducing unit manpower requirements. "In fact," said Reynolds, "an increase in productivity furnishes the only sound basis on which a higher wage structure can be maintained so as to mean anything to workers."

Reynolds refuted the common notion "that the nation's industrial plant is at once physically capable of smothering the economy with the low-cost goods now needed to supply the accumulated demands of consumers." The stifling government controls must be removed, asserted Reynolds, if new machinery is to become available to industry in the needed quantities.

Dr. Charles M. Edwards, Jr., Dean, School of Retailing, New York University, "What the Retailers and Consumers Need to Know About Plastics:" Dr. Edwards decried the complexity of the industry and its forbidding terminology. The consumer and the retailer, he said, are not going to technical schools to learn the language of the plastics industry. Simplification of terminology is one of several actions the industry must take if it is to win for plastics goods "the full measure of acceptance and adoption they deserve," he said, and he also recommended more constructive applications of plastics, avoidance of unsuitable applications, adoption of a pre-testing program, informative labeling, and the formation of "a still stronger combination through your Society for the promotion and protection of your mutual interests."

Frederick Z. Pearson, Lyon Metal Products, Inc., "The Competitive Position of Structural Plastics Materials": Though Pearson acknowledged that it was "quite an undertaking to reconcile our materials and methods with steel at three cents a pound and punch press rates of operation," and to meet the competition of wood-base products, he felt the low pressure industry could in time "successfully face the competition."

"Competition exists," said Pearson, "wherever quality, quantity, and cost are considered, and I place cost in last place advisedly. Some people think that competition only means cutting costs and being a few cents lower than your immediate competitor. Actually in any competition, of course, it is the most efficient item that wins out, the product giving best performance at minimum cost."

Pearson predicted that most present methods of low pressure laminated molding and most resins now in use will not be able to justify themselves economically, except in production volume below 3,000 units, in making unusually large parts, or where there are frequent design changes. The desirability of mass production techniques was also emphasized.

As to some currently publicized uses of structural plastics, Pearson declared: "The glamor of plastics and the low tooling costs allowed by present methods have encouraged investigation of structural plastics in automotive, housing, and refrigerator manufacture, but it is my contention that these very same methods discourage the adaptation of structural plastics to other than small volume merchandise, because they place the finished product for price and performance on an unfair basis."

R. A. Hoffer, E. I. du Pont de Nemours & Co., "Application of Low Density Core Materials": The use of low density core materials has increased greatly since

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the war, said Hoffer, especially in aircraft construction, and he named some two dozen applications. "Great interest is developing in low pressure fabrication of boat hulls and other structural members," Hoffer declared, and he pointed out that core materials are light in weight, are good acoustical and thermal insulation, and are simple in structure.

Suggested uses include luggage; wall panels, flooring, cabinets, and exterior panels for housing; tops and side panels for house trailers; and many refrigerator applications for which the cores are well suited because of their insulation qualities.

John J. Townsend, Engineer and Consultant, "Tooling and Production Methods for Low Pressure Reinforced Plastics": To illustrate the possibilities in low pressure laminating, Townsend listed the five methods he considered most adaptable to high-volume items of merchandise, as follows: (1) molded plywood; (2) formed wood laminates; (3) post-formed fabric laminates; (4) fluid-pressure molded laminates; and (5) matted fiber reinforced plastics. He then discussed each method (or technique) in considerable detail, naming typical items and describing the materials, equipment, and processes used in their manufacture.

Wiley D. Wenger, Radio Corp. of America, "Practical Methods for Heat-Sealing Thermoplastics with High-Frequency Energy": Plastics fabrics such as dress shields, bathing caps, raincoats, shower curtains, and many other thermoplastics products are now being sealed electronically. War-time experience proved, Wenger asserted, that such products can be made faster, better, and cheaper with electronic heating, a major advantage of which, he pointed out, is that the energy employed is not converted into heat until it enters the work material. This results in a quick concentration of heat at the interface of two pieces of material where it is wanted.

Frank Carman, PMMA, "Massachusetts Institute of Technology Plastics Research Project": The general purpose of the recently-announced PMMA-supported research project at M. I. T. was announced as "a study of mechanical properties of plastics aimed at a more fundamental understanding of the physical mechanical nature of plastics materials, the development of methods of testing to permit determination of these fundamental properties, and the development of ways of using fundamental properties of this type in the design of plastics structures or use of plastics."

More specifically, he said that "the program will include consideration of the effect of molding method on the mechanical properties of plastics parts; how the rate at which loads are applied affects the strength properties and ductility of these materials; how they may be expected to act when loads are applied over long periods of time; what may happen when loads are repeatedly applied and removed as in structures subjected to vibration; what the effect of different temperatures may be upon plastics of various types; and what may be the effect of age upon the strength properties. These studies will include development of new test procedures and/or equipment to the extent which the research indicates practicable."

The points were made that the new program is not supplanting any other plastics research and that it would not consider the development and use of specific materials, which was said to be the province of the individual research laboratories of PMMA members.

C. C. Concannon, Chief, Chemicals and Drugs Division, U. S. Department of Commerce, "The Plastics Picture in South America": In examining export mar-

kets," Concannon said, "the industry is looking first to our Latin American neighbors." Exports of plastics and synthetic resins to Latin America totaled about $2,500,000 in 1935, a normal pre-war year, and about $2,040,000 in 1944 (or approximately 12% of the total $17,000,000 worth exported).

In dealing with our Latin American neighbors, Concannon emphasized the need for careful consideration of their time-honored business methods and customs. Other problems discussed included choice of sales outlets, Latin American needs, the principal markets, and statistics on South American imports and exports.

Factors affecting the attitude of the U. S. plastics industry toward South American markets were listed as "available supply of plastics materials from other countries to South America; ability of the U. S. plastics industry to compete on a price and credit basis with other countries; the size of the U. S. post-war domestic market; the U. S. plastics industry's stock situation; and the strides that South America makes or will make in supplying its own needs for plastics materials."

John E. Stokes, Bakelite Corp., "Low-Pressure Molding": Stokes listed a number of advantages of low-pressure molding, described a number of processes, and talked about present and possible uses. Prior to 1940, it was pointed out, molded laminates were made with 1000-2500 psi, whereas today there are approximately a hundred resins usable in low-pressure molding, the types of molds are numerous, and the laminating processes are varied. Stokes declared: "Low-pressure molding is rightfully taking its place in the plastics industry because laminates are not substitutes; they are the best material available for many requirements if properly used."

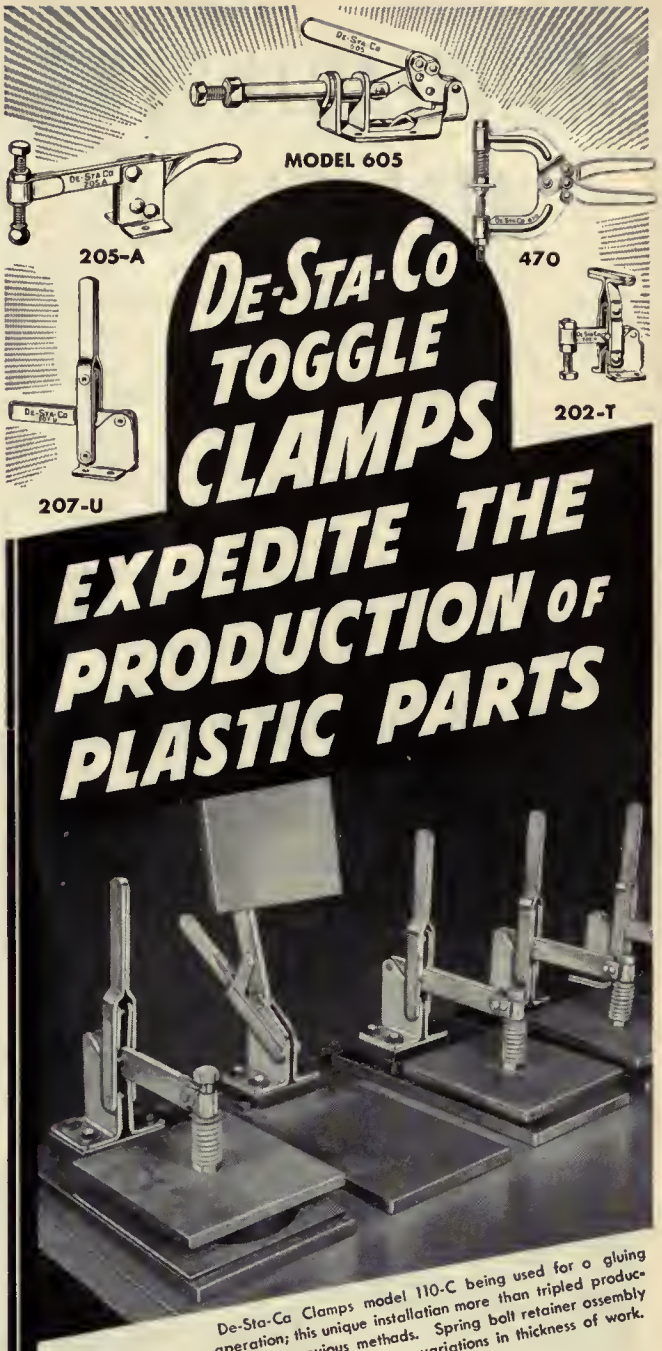
There is a trend toward the use of low-density cores, according to Stokes, and he commented on the "remarkable downward trend in the cost of commercially available honeycomb panels."

Among applications or suggested uses are radomes; aircraft parts; small boats; numerous electrical parts; parts made from deep-drawn laminates such as the Andover Kent Aviation Corp.'s "Ice Saver" bucket; bathroom scale housings; automobile bumpers, hoods, fenders, and other parts; station wagon bodies; canoes; and freezing units.

Charles W. Dorn, Director, Research Laboratory, J. C. Penney Co., Inc., "The Necessity of Sound Test Methods and Their Correlation to End Use": In talking before the recently-formed Plastic Film, Unsupported Sheet and Fabric Division, Dorn pointed out that the fact that plastics sheets and films are in competition with old established materials makes especially necessary the careful testing of products before they go on the market. Dorn surveyed the work being done by the American Association of Textile Chemists and Colorists to develop improved standards and tests, and urged the immediate setting up of a projected SPI-AATCC sponsored committee to co-operate in carrying on such work.

(Following Dorn on the program, L. S. Little, of du Pont, Chairman of the Executive Committee on Research of the AATCC, gave a short talk on the activities of his committee; and Mark Bortman, Bortman Plastics Co., gave a short analysis of the current status of the sheet and film industry, stressing the need for the proposed committee on testing and standards. In planning for such a committee, he declared, the SPI expects a rising demand for plastics films and sheets.)

The last Conference address, "A Pattern for Collective Bargaining," by Benjamin Werne, Counsellor-at-Law, was not available for publication. END



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Automatic Box Folding

(*Continued from page 62*)

A neat trick during production facilitates the shipping of the boxes. The tissue paper in which the plastics sheets are wrapped is not removed prior to the shaping operation, but is simply left in place. Nothing happens to it in the machine, with the result that the finished box has a ready-made wrapper to protect it from surface damage during shipment.

A strong selling point of these boxes is their re-use value. As the company's slogan has it, the *OxBox* is "The Box You Never Throw Away." That gives it an extra value as a container for consumer products, but the sales possibilities of the empty containers themselves are also great. Certain chain stores are negotiating for the purchase of the *OxBox* itself, in order to resell it as a gift box. The idea is that people buying low price merchandise for gifts—handkerchiefs or popular jewelry, for example—would enhance its value by placing it in a handsome box. A series of 18 sizes is contemplated for this purpose, to retail at from 10 to 50c.

Conversion of Boxes

Another merchandising possibility is the sale of the new type box to convert conventional pasteboard or even wooden boxes. Thus, the old covers could be discarded for a transparent top, or the old body could be replaced by a more colorful plastics body.

The folding machines can be used to make the all-over type of picture holder, which can also serve effectively as a window for dealer aids. The mounting board for these holders has a notch at the top which permits it to be hung on a wall as well as stood up on a counter.

The unit discussed thus far, which has a capacity of 1500 boxes a day, is described as semi-automatic, since it is not fed sheet stock but bench-formed slotted blanks. Although its exact cost has not been definitely set, it is understood that it will be below $1,000, and, according to Oxley, it is so simple that it can be installed in the morning and be in production in the afternoon. His plans at present also call for supplying slotted blanks ready for the forming operation.

Here are largest and deepest boxes yet made, small boxes, and (right) boxes with printed designs. Sizes to date have been limited by size of sheet available, not by capacity of the Oxley machine. The tiny boxes have been made from the cuttings left over in manufacture of large containers

A fully automatic folding machine, working straight from the sheet, is expected to be ready within three or four months. Where board to be formed is scored, plastics must be heated. While this problem has been entirely solved on the semi-automatic machine, as noted, it is more complex in the fully automatic machine. Here, the one factor awaiting complete solution is the requisite shifting of the points of application of heat.

At the Oxley plant, present production is reported at 5,000 boxes a day—a figure which will be trebled, it is said, when materials again begin to flow freely. END

The article "Container Fabrication" elsewhere in this issue was recently prepared to present the newest in plastics container manufacture. Proving the rapidity with which this phase of the industry is progressing, however, is this account, just received, of the latest development in the fabrication of folded containers. To a degree, it makes obsolete some of the statements in the other article, to which it thus becomes a significant supplement.—ED.

Packaged for Preservation

(*Continued from page 77*)

a number of applications for certain types of paper and metals coatings, and paper converters, film and foil producers and the packaging industry, say the Dow people, should find the heat sealing properties, provided in both of these new coatings, particularly interesting.

In addition to the use of spray-packaging for machinery and equipment, the scope of protective packaging in a variety of fields is illustrated in a growing list of applications. Many notable examples of these uses were shown at the Packaging Exposition. Among them was the special exhibit prepared by Celanese Plastics Corp., in which seven different types of Lumarith plastics packaging were displayed. Wraps, bags, envelopes, "window" containers, rigid containers, laminations or combinations, molded packages and a special panel of unique applications, were included in the Celanese exhibit.

Adaptability Demonstrated

The adaptability of *Lumarith* as packaging for foods, drugs, cosmetics, linens, undergarments, and a variety of other items, including special industrial parts, was demonstrated by sample packages showing such use. Map and blueprint coverings, training manuals, pressure sensitive tape, price tags, and ready-made sign materials were indicative of the special applications to which this material can be put.

And a prominent part of this exhibit was given over to a daily display of *Lumarith*-packaged "perishables" such as fresh fruits, flowers, and vegetables, sent by air from Florida, Louisiana, and the West Coast, each day.

Packaging of frozen foods was highlighted in an exhibit of Western Products, Inc., and The Goodyear Tire & Rubber Co., of a kit utilizing the latter-named company's new low temperature packaging material, *FF Pliofilm*.

This kit, which is to be made available at locker plants and retail stores, is to contain pint and quart size *Pliofilm* bags and collapsible cardboard cartons, the *Pliofilm* bags, according to a Western Products official, being so constructed that they can be entirely heat-sealed with a household electric iron.

The material, says Dr. M. D. Coulter of Goodyear's research laboratory, retains its flexibility at —20° F, has no brittleness at that temperature, and can be heat-sealed against the frozen product, if desired. END

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Testing the End Product

(*Continued from page 60*)

ternal structure of the molded article without destroying the piece. We can detect porosity, the positioning of metal inserts, and stray metal inclusions which would affect the electrical characteristics of the finished part.

Some other factors producing a difference between the data sheet values and the values of the finished product are: design of the product; method of molding; temperature, curing time, and pressure used in molding; physical dimensions; and temperature and humidity. Let us examine these factors one at a time, to see why it is necessary to test a product itself to get its actual properties.

Design

In molded objects having thick and thin sections adjacent to each other, the difference in shrinkage between the sections sets up stresses which greatly alter the physical properties. Sharp corners in a molded part can prevent adequate flow of the molding powder while curing, so that it lies "dead" and makes for a heterogeneous mass. In a product molded under these conditions, tensile strength and impact resistance would be reduced below the values obtained from standard test pieces of the same molding compound.

Another important consideration for fiber-filled material is the orientation of the fibers with respect to sections of the molded article. Broadly speaking, any part in the molded article that receives stress, such as tabs or projections, interferes with the normal flow of the molding powder, and can seriously alter the physical properties.

Method of Molding

The method of molding also has an important influence on the final physical properties. For example, the molding powder is heated more uniformly in transfer molding than in compression molding, by going through the sprues and gates. There is no tendency toward the formation of voids or porosity, since the entrapped air is pushed out ahead of the molten plastics. This makes for a uniformly dense material having good physical properties. However, the size of the gate and its position in relation to the molded piece are factors to be considered, for too small a gate can break down the fiber size, thus destroying the physical properties that are dependent upon fiber length. The position of the gate influences the alignment of fibers. For best results the applied stress should be perpendicular to the direction of the fibers.

In using semi-positive and positive molds in which the molding powder is heated by conduction, internal porosity may result in the molded article if the flow is not adequate and the entrapped gasses removed. Only a test of the finished product can reveal whether it has escaped such pitfalls and has the properties it requires for good performance.

Temperature

The mold temperature exerts an important influence on the final properties, in that "case hardening," burning, and a reduction in flow may occur if the temperature is too high. If the temperature is too low, molding difficulties will be present and the molding powder will not flow into all of the recesses in the mold cavity and the product will be weak. Again, tests must be made to show whether or not it has succumbed to this weakness.

Molding temperature is closely connected with curing time. Usually, the higher the molding temperature, the

shorter the curing time, and vice versa. It is possible to determine whether the material has been cured sufficiently by acetone extraction for phenolics and water absorption for ureas. Although the final physical properties of phenolics are not appreciably affected by over-curing, excessive curing of ureas and melamines can cause an increase in water absorption and burning of the surface of the molded piece. Ordinarily, correctly cured melamines are resistant to boiling water, whereas improperly cured pieces will "chalk" or disintegrate.

Pressure

Molding pressure should be sufficient to cause the molding powder to flow and fill out the mold cavity. Insufficient pressure can cause porosity, and excessive pressure can, for fibrous plastics, break down the fibrous structure or force the plastics molecules into the fibers, so that their effectiveness is reduced. Usually impregnation of fibers by molecules of plastics decreases the strength but increases the water resistance, whereas in the coating process the physical properties are somewhat better but the water resistance is not as good.

Physical Dimensions

As stated above, in obtaining standard physical data of molding materials, definite sizes and shapes are taken, and, in some cases, the physical or electrical results pertain only to a given thickness and shape. For example, in the case of dielectric strength, ASTM specifies a disc of 4" in diameter with a thickness of 0.125". In the case of a commercial amino plastics, the dielectric strength, using the ASTM short time test, is approximately 325 v per mil. When the sample was only 40 mils thick, the dielectric strength was approximately 570 v per mil, whereas with a thickness of 200 mils the dielectric strength is 240 v per mil. Obviously, in this case, thickness must be taken into consideration, together with the type of plastics, when dielectric strength is of prime importance in the functioning of the finished piece.

Temperature and Humidity

To complicate matters further, the temperature and humidity at the time of testing of the piece, together with the history of the molded article, can affect the dielectric strength. In the case of a melamine aldehyde plastics, there is a definite decrease in dielectric strength with increased temperature. As an example, at 80° F the dielectric strength is 360 v per mil, whereas at 320° F it is only 90 v per mil.

Conclusion

Because of the numerous factors that enter into the manufacture and use of finished plastics goods, only by testing the final product itself can the manufacturer assure the customer uniform and satisfactory properties. END

Ed. Note: The validity of the points made in Mr. Sjostedt's article receives further substantiation by the publication in April of Chapter 4 of the SPI Handbook, "Testing Plastics Parts," which, it is announced, was prepared to guide the plastics industry in setting up its own performance tests.

Tests made in accordance with ASTM and other standard methods, the introduction continues, "usually utilize standard specimens prepared for the purpose; they are particularly valuable in the establishment of comparative data on the plastics themselves. But since fabricated articles are often irregular in shape and non-uniform in wall thicknesses and may have areas of weakness resulting from location of sprues, type of gate, molding technique, and design, it is often desirable to make tests on the actual article, in order to determine its performance under conditions of service."

The SPI publication then suggests a number of tests for production items, arranged in the following classifications: Impact; Moisture Resistance; Dimensional Stability; Effect of Temperature; Crushing; and Miscellaneous.

The new chapter was prepared by the following sub-committee: Dr. Garson Meyer, Eastman Kodak Co., Chairman; Dr. Robert Burns, Bell Telephone Laboratories; E. B. Cooper, E. I. du Pont de Nemours & Co.; Dr. Ray B. Crepps, Owens-Corning Fiberglas Corp.; Lawrence M. Debing, Monsanto Chemical Co.; Alfred A. Glidden; A. J. Kearfott, General Motors Corp.; Dr. Gordon M. Kline, National Bureau of Standards; Roger MacDonald, Plastic Manufacturers, Inc.; A. A. Melnychuk, Celanese Plastics Corp.; Dr. Leonard Smidth, Sylvan Plastics, Inc.; John K. Totteu, Ford Motor Co.; and F. E. Wiley, Plax Corp.

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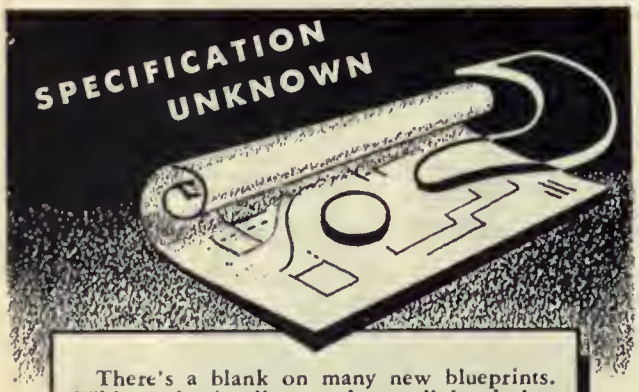

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German Plastics, Part III

(*Continued from page 42*)

providing acid-resisting soles for submarine crews. Cold resistance was said to be good to—30°C. In one plant, polyvinyl chloride paste shoe soles were made in a battery of 4 new machines each about 8′ wide, 45′ long and 7′ high The sole material was produced in rolls 37″ wide and 3 mm (.120″) minimum thickness. A 4′ wide, basket-woven, chrome-nickel screen continuous belt, with rather an unusual design, passed through the heating oven in a horizontal plane. At the feed end of the belt, the PCU paste was fed onto the belt in a combined feed trough-doctor knife casting device. The belt passed through the oven, heated to 160°C (320°F) by recirculating gas-heated air. The time for traveling the 45′ varied from 1 to 8 hr, depending upon the thickness being cast. The product coming off the belt was embossed with a roughened roller on its top surface to give a good cementing face. It passed underneath the cooling roll and was wound up. The life of the special belt was said to be several years, according to the experience obtained on the first machine available, which was still in running condition.

The chief use of polyvinyl chloride paste in fabric coating was in covering jute sacking for use in bags, wrappers for Buna rubber bales, or other shipping containers where chemical action or contamination was an important consideration. The coating was applied in two passes. First, the paste was applied to the jute web with a doctor knife and the coating passed over a hot drum about 6′ in diameter for the heat setting. This primed cloth, after cooling and reeling, was further coated to a total weight of 300 gm per square meter on a more elaborate spreader. Here the cloth, coated side up, passed onto a casting belt made of soft polyvinyl chloride about ½″ thick. This belt rolled over two large rollers about 9″ in diameter and 5′ long, spaced about 30″ apart. A small idler about 4″ in diameter was placed between them to allow the paste to rise in a depression in the belt under the doctor blade. Cold paste flowed into this pool from an overhead reservoir, passed beneath the doctor, and, as it left the casting belt, went under a spreader knife which removed excess paste, permitting overflow at the ends. This overflow was then recovered. The sheet was coated at a speed of 15 meters per minute (50′), and passed to a short festoon drying chamber where it was exposed to 160°C (320°F) gas-heated air for 2 to 5 min. This setup coating passed between a weighted-steel top roller and a cooled, hard-rubber bottom roll to chill it before reeling.

Other types of coatings were also made in much the same fashion. For example, a cloth printed on one side was coated with paste on the reverse to give a smooth inside film. This sheeting was used for packing fish. Some raincoat cloth was coated in this fashion. Cotton duck was coated with 1.5 mm (.060″) layer of paste, and this was then laminated with another layer of duck to make a 3-ply sandwich used for a container for aircraft use. Similar cloths were used for pneumatic life rafts and life boats. One plant alone was capable of handling the equivalent of 500,000 of the large bags per month. The same plant's capacity on polyvinyl chloride paste shoe sole stock was 100 tons per month.

Polyvinyl chloride paste was effectively used in dipping processes for producing such items as chemically resistant gloves and some surgical items. In this process, heavy aluminum forms were heated to 120°C (248°F) to expedite setting of the paste. They were then dipped, withdrawn, and heated for 10 sec at 160°C (320°F) in a hot

tunnel to give a finish structure ½ mm (.02") thick. Tear strength on these products was low.

While the products produced by this paste-casting method were limited to a certain narrow range of physical properties, considerable developmental work was underway to expand this range of properties and to use this extremely simple production process in other fields. It was indicated that the progress in the past few years on this method of fabrication had been rapid and that under normal circumstances progress in the future would have been equally rapid. (TO BE CONTINUED)

Silicone Resins

(*Continued from page* 55)

even though the insulation was still in satisfactory condition.

(3) A few mining locomotive motors, street railway motors, and trolley coach motors have been with silicone materials and are now being tested in the field. Some have already given service far beyond that obtained with conventional materials.

(4) Magnet coils for relays and contactors, and several hundred dry type transformers have been insulated with silicone materials and placed in service.

The foregoing applications are typical of the ways in which the high thermal endurance properties of silicone resins and materials can be applied to industrial equipment. Other suggested uses are as follows:

(1) Reduced weight/horsepower by operation at higher temperature with no sacrifice in life: rapid reversing motors; fan-cooled motors; variable voltage drives where ventilating is reduced at low speeds with normal current in windings; machine tool motors where space is limited; submarine propulsion motors; marine motors where saving in weight and space are important; some hoist applications; crane motors; wood working where motors are shell type or built-in; and short-time rated motors with extremely limited weight and space conditions.

(2) Increased life of insulation while maintaining conventional size, weight, and temperature rise: loaders, drills, shuttle cars, coal cutter motors, etc. in mining applications; motors for creamery applications where humidity is high; motors handling fluctuating loads with high peaks; motors operating in caustic and acid fumes; pickling, cleaning, and plating lines; and motors used in high-humidity tropical locations.

(3) Operation in high ambient temperatures: furnace motors; roll table motors; ventilating fans; circulating fans handling hot gases; dry kiln motors; copper mining application such as scraper hoists; cooling tower motors (high humidity and ambient); open hearth department; Bessemer converters; forced draft blowers in marine boiler rooms; and boiler room auxiliaries on shipboard (that is, oil burner motors, oil pump motors, etc.).

It will be noted that some applications overlap, and also that some applications must be carefully studied to insure proper results. For instance, on machine tool motors care must be exercised to insure that the higher temperatures involved will not affect the accuracy of machining. Another precaution to be taken is one of keeping the bearing temperatures at safe operating temperatures. The safe temperature for grease lubricated bearings is 110° C total temperature if the proper lubricant is used. It may be necessary to

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It must not be assumed that silicone insulation is a "cure-all" for motor ills. While an excellent insulating material, it must be applied with extreme care if maximum utilization of its properties is to be realized. As more and more equipment becomes available for handling the manufacturing processes, then, and only then, can there be extensive use of silicone motors.

To evaluate completely the possible advantages to be realized by using the increased operating temperature silicone offers, certain characteristics must be considered. The following study is based on increasing temperature only, the speeds and insulation allowances being conventional. It should be remembered that other problems are introduced, particularly mechanical problems as previously mentioned. Obviously, these problems can be solved only by experience on specific applications. Other considerations relate to performance—efficiency and power factor. In other words, it should be recognized that the major advantages derived from silicone insulation are accomplished only through a balanced design:

(1) Small industrial motors: Most designs in commercial production are Class A, 40° C rise machines. Some weight reduction would be possible on certain designs in going to 50° C rise without change in insulation. Further weight reductions would be possible on some of these by using conventional Class B insulation. On some motors, such as the open and splash-proof types, the torques, efficiency, and power factor requirements limit the advantages to be gained by use of the high-temperature insulation. On some totally enclosed fan-cooled motors the same factors may well apply. However, there may be more possibilities in redesign for weight reduction because the operating temperature, frequently the limit in design, has been increased.

(2) Large synchronous and induction motors: The larger machines and higher speed machines could in some cases be reduced in weight by utilizing fully the present Class B temperature limits. In addition, there are some of those larger or higher speed designs which could be made still smaller, if an increase of 40° C were possible above present Class B limits. In most cases, the maximum possible gain in size and weight reduction through increase in permissible temperature will require some sacrifice in efficiency and power factor on induction machines.

(3) Large direct-current machines: The effect of temperature on size and rating of this class of equipment depends upon the design characteristics, particularly on the ratio of copper loss to iron loss. Their design is standardized through establishment of lines of frame sizes to fit widely varying conditions. This naturally results in some machines being larger and heavier than those specifically made to suit a particular application.

As fibrous glass was introduced to various industries, new hopes were held for higher operating temperatures, but suitable treating materials were not available. Now, with silicone resins indicating that the desired results can be achieved, both in the laboratory and in the field, extensive use of high temperature silicone insulation can be expected. Many types of electrical machines are larger and heavier than need be if high-temperature silicone insulation is used. In some instances it may be desirable to supply renewal parts treated with silicone for existing equipment which has a short life or requires increased power. Since silicone processes and materials are still relatively new and require additional development, the cost of the silicone insulated machine is necessarily higher than the more conventional types. In any event, the new silicone materials must not be considered as the "cure-all" for all insulation problems, but must be applied with caution and vision on specific applications where their use can be justified. END

Pliobond: A New Adhesive

(Continued from page 75)

Because of the variety of plastics, it is not possible to cite the specific method to be employed in bonding plastics generally with this adhesive. However, thermosetting plastics are impervious to the solvent used, and for this reason the hot, or dry, bonding method should generally be used to obtain the best results. On the other hand, many thermoplastics, such as vinyl chloride-acetate, are soluble in this solvent and may require bonding by the reactivation method. Also, the fact that they are thermoplastic generally precludes the possibility of employing heat.

The United States Plywood Corporation became interested in Pliobond when they found it produced better results than anything they had used previously in making *Armorply*, a lamination of plywood and metal produced by a hot-press method. This material was utilized by the army for several packing specifications. Today, a product which has more general civilian potentialities, *Decorative Armorply*, produced by laminating thin veneers to various metals, is being promoted.

This company has also prepared a campaign for selling the adhesive in tube form for home use, to be distributed through chain stores. END

Blanking Thermoplastics

(Continued from page 70)

quently blanked or punched at room temperature, but this should preferably never be below 70° F. In greater thicknesses, say ¼" and over, the material is generally heated to a temperature of at least 125° F and in some cases may be heated as high as 225° F. Cellulose acetate is sometimes blanked in gauges up to ½".

Methyl methacrylate resin is commercially blanked in thicknesses up to 0.375". Generally, it must be blanked at a temperature no lower than 250° F. The temperature of the room in which the blanking is done should be at least 70° F. In heavy gauges it is frequently desirable to heat sheeting up to approximately 300° F prior to blanking or punching.

Ethyl cellulose is usually blanked at relatively low temperatures. On thick sheets, temperatures up to 180° F have been used. Material up to ½" in thickness can be worked by this technique, although generally ¼" thickness is considered to be the limit.

Vinylidene chloride polymer, in thin gauges, is blanked or punched at room temperature. In thicknesses of approximately ¼", the material is sometimes heated up to 160° F.

The blanking characteristics of rigid vinyl chloride copolymers are somewhat similar to those of vinylidene chloride polymer. Light gauges are blanked cold, while the heavy material is heated to temperatures up to 190° F.

Non-rigid vinyl chloride copolymers, because of their flexibility, are usually blanked cold. High-speed clicking press techniques are particularly applicable.

Polystyrene sheets in thicknesses up to 0.040" can usually be blanked or punched at room temperature. Laminated oriented sheets up to 0.125" may be similarly worked. Blanking of heavy material is seldom attempted.

Casein is usually blanked at temperatures from 100 to 200° F. Preferably sheets are either soaked in water over night prior to blanking, or are actually heated in a water bath. This material is frequently blanked in thicknesses up to ¼".

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In laying out equipment for blanking and punching thermoplastics, it is essential that the ovens, tables or other heating equipment be located adjacent to the presses in which the work is to be done. Extremely large units serving a battery of presses are not desirable. Better overall yields will be obtained if equipment of a suitable size to serve an individual press or pair of presses is placed directly adjacent thereto. This type of installation prevents cooling of the work between the heating unit and the press and thus permits a greater number of pieces to be blanked or punched before it is necessary to reheat the sheeting.

In a properly worked out installation, it is quite frequently feasible to blank an entire sheet or at least a precut portion of a sheet without returning it to the oven or heating tables. Similarly, blanking presses should not be placed near windows or doors where drafts are likely to cause the surface of the sheets to cool between heating units and presses. It is, of course, essential that the operator blank material as rapidly as possible, since the length of time between the removal from the heating unit and the actual cutting determines the number of pieces that can be blanked with a smooth edge.

Die Setups

Dies of the steel-rule or clicking type are often placed on the surface of the sheet which is to be cut. Steel-rule dies are frequently mounted in a printing press, particularly when they are used for trimming to shape. Clicking dies are used in the same manner or in what is commonly termed a clicking press. After a stroke of the press, the dies are raised, the rubber pads eject the piece and the die may then be placed on another portion of the sheet.

Dies of the open-faced type are similarly placed on the sheet and moved after each cut. The operator should blank enough pieces to fill the die within ¼" of the top and then eject the pieces by upsetting the die or throwing the blanks out. Finished pieces, particularly those of heavy cross-section, should be laid flat and in some cases weighted until they are cool, so as to prevent warping. In some instances, particularly with methyl methacrylate sheeting, it is desirable to cool the pieces in water to a temperature of about 80° F prior to handling them further.

Outline-blanking dies of the ejector type may be used manually in a manner analogous to that just described for the use of open-faced dies. However, more commonly they are fastened to the movable head or base of a press and the operator merely feeds sheets or strips of sheeting to the die on each stroke. Frequently a jet of air is played against the work in order to blow the cut piece clear of the next stroke of the press.

Punching dies are operated in a manner similar to that just outlined for ejecting outline-blanking dies, with the one essential difference that the die is fastened to the base of the press and the punch to the movable member. The die usually has an open bottom and the punched work is forced through by the successive strokes of the press.

Press Settings

In setting the distance of the movable platen of the press from the base, it is good practice to make certain first that there is sufficient clearance, that is, more than 2¾" if 2¾" has been selected as standard height for the dies. The press structure should then be adjusted so that when the movable platen strikes the die it will cause an imprint of the die not more than 0.003" deep to appear on the face of the cutting board. Adjustment to this accuracy will permit clean cutting, prevent rapid wear of the cutting board, eliminate sticking of the die, and prevent breaking or excessive dulling of the sharp edge.

The use of lubricants is sometimes advantageous. They may be applied to the cutting edges of the tools, but are

more generally applied to the face of the cutting board. Hard white soap which can easily be rubbed on the face of the board has proved most satisfactory for general work.

Plasticized polyvinyl butyral sheeting tends to become tacky or self-adherent at elevated temperatures, particularly after the powder usually applied to such materials has been removed by wiping or washing. Consequently care should be exercised to prevent overheating during storage and not to remove the powder until after blanking operations have been completed.

In cutting thick sheets of polyethylene, it may frequently be necessary to use lower temperatures than those suggested above in order to make the material more rigid and to prevent pieces from having a concave edge.

Low room temperature or storage in excessively dry atmosphere is likely to make cellulose acetate temporarily brittle, so that it will shatter or crack under the impact of a blanking die. Consequently suitable temperatures and humidities must be maintained in the storage of this sheeting prior to blanking it.

Removal of Masking Paper

Methyl methacrylate sheeting is supplied with a masking paper which is applied to protect its high finish. This masking paper should be removed from both surfaces prior to heating and blanking unless the blanked article is to be tumble-ashed and polished. In the latter case, the paper will be removed by the tumbling operation. In the former case, masking paper is removed by simply pulling it away from the surface of the sheet and wiping with a soft cotton batting or cotton wool flannel which has been moistened with hexane, *Solvesso, Varsol* or methanol.

Cellulose nitrate plastics, as is well known, are flammable; consequently, care should be used to prevent over-exposure to heat. Either excessive temperature or prolonged exposure is undesirable.

Ethyl cellulose softens very readily, and consequently should not be overheated if good surface is to be maintained.

The crystalline nature of vinylidene chloride polymer makes for rather sharp softening. Thus, care should be used in preheating to prevent the material from becoming too soft to be readily handled. Low temperature storage causes temporary embrittlement and hence should be avoided.

While rigid vinyl chloride copolymers are almost completely non-flammable, there is some tendency to discolor on excessive heating. For that reason, time of heating as well as temperature should be kept to a minimum. Such materials are also temporarily embrittled by cold and hence should be stored at suitable temperatures. END

[1]Crane, E. V., *Plastic Working in Presses*, pp. 51-80, New York, John Wiley & Sons, Inc., 1944.
[2] Simonds, H. R., C. Ellis and M. H. Bigelow, *Handbook of Plastics*, p. 609, New York, D. Van Nostrand Company, 1943.

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Injection Mold Design, Part II

(*Continued from page* 47)

above with a hoist if this long plate were in place. However, without the back plate, the die can be lowered in position and the stripper put in place from the front before the moving half is clamped into the press.

On the top of the injection half, we have a locating ring or pilot which is used to locate the die properly in the center of the injection platen. This should not be turned solid on the plate, but should be a separate piece bolted and doweled to the plate. Different machines have different-sized pilot holes, and a ring turned solid on the plate limits the flexibility of scheduling the die on various types of equipment.

On all multi-cavity molds we must determine the correct layout for the cavities. There are four patterns, one of which will usually be the answer to the problem. These are (a) circular, (b) two parallel rows, (c) cross rows, and (d) four or more parallel rows. (TO BE CONTINUED)

Continuous Films

(*Continued from page* 30)

of nitrate when exposed to sunlight. For some years the acetate film held this field, although at low temperatures the glass-acetate combination shattered readily. Shortly before the war, vinyl butyral production was adequate for the growing safety glass field. The butyral gave effective protection at much lower temperatures than the acetate did. With this change, the production of cellulose acetate for safety glass halted abruptly, and production did not climb again until new demands arose for rigid, transparent packaging. The war shut down the production of both the butyral and the acetate, but only for a short time.

With the war, films were put to many new uses. Cellulose acetate was used for protecting important charts and documents by laminating. Goggles for fliers as well as land troops were made with acetate lenses. Interestingly enough, these lenses were made more resistant to solvent action and scratching by a surface chemical treatment which changed the outer layer of cellulose acetate back to its parent substance, cellulose. This sort of treatment will doubtless prove advantageous with some future film applications. The technique of accomplishing this has been used for years in preparing photographic film casting surfaces but its application to goggles is one of the first for a consumer product.

Water Emulsion Casting

The vinyl butyral film was produced for protective coatings against water to replace the natural rubber and to fill the gap left by the withdrawal of the chlorinated and cycloized rubber films from production. Even with the manifold expansion in the production facilities for vinyl materials, the demand was so great that there was insufficient vinyl butyral for use with laminated lead and paper for the moisture-proof packaging of Ordnance materials. Large volumes of heat-sealing cellophane were also used for this laminated paper-lead combination, but the war-time development of water emulsion casting of the vinyl butyral simplified production in favor of the butyral combination. The water emulsion casting will produce a substantial amount of vinyl film in the coming years. The fact that solvents and expensive solvent recovery systems are not needed makes it adaptable for use by small concerns in their own particular fields.

The idea of a plastics sheet to replace tracing cloth has been considered. For material, vinyl formal seems to have the edge in physical properties. Before the war its cost was somewhat high and the technique for casting had not been developed. With the present capacity for vinyls and new developments in the technique of producing film, this situation should change soon.

Now that civilian production is being resumed, many manufacturers are designing equipment to produce film in greater widths to meet customer demands. At present, 48″ is the maximum width produced. The next step will probably be the casting of 56″ material. Some films, such as ethyl cellulose and polystyrene, at present have a maximum width of only 25″. The trend is toward greater widths. The technique of handling and stretching extruded film progressed rapidly during the war, both in this country and in Germany. This information will be used to advantage in producing better and wider films in the coming years. Polystyrene film must be stretched two to four times its extruded width and an equal amount in the direction of extrusion to produce a useable film. Similarly, polyvinylidene chloride film must be stretched to produce the orientation of the molecules necessary to give it strength.

Possibility of Thermosetting Film

Continuous plastics films of thermosetting materials are not outside the range of possibility for the coming years. With the allyl ester styrene copolymers now being used for the continuous coating of paper and fabrics for use as wallboard surfaces, the step to the production of clear films is not far off. The exceptional abrasion resistance of this material, along with its immunity to solvent action, opens up many new possibilities.

Thin coatings of plastics have long been applied to many continuous materials to enhance their appearance and to protect their surface. The amount of material applied has been limited by the small amount which can be laid down satisfactorily in a single coating operation and by the cost of the plastics itself. Printed designs under the coating had to be done with special inks to avoid lifting or blurring by the solvent action. Now that plastics are cheaper, a heavier coating, with its better protection and greater brilliance for printed matter, will be possible. While such heavy coatings will probably not be applied by the conventional coating machine, plenty of laminating machinery is available to utilize a prepared film. Again, as with solvent casting, solvent recovery systems are necessary for large-run coating operations, and the cost of such recovery equipment is prohibitive for the small manufacturer. By using standard laminating equipment and simple laminating techniques, the individual producer is assured of a heavy, glossy, flexible finish which will protect his printed paper or his cloth product.

Transparency Desirable

The Air Force has pointed the way toward the proper packaging of individual machine replacement parts in its use of rigid, transparent containers. These may be hot drawn, spirally wound, or straight fabricated containers. If necessary, the container may be easily sealed by solvent action, but the enclosed part is always ready for inspection and is protected from moisture and handling. The transparent container will lend a sales appeal in addition to its utilitarian use. Of course the rigid, transparent boxes designed for orchids, hairbrushes, and baby slippers will continue to use an ever-increasing volume of the cheaper transparent films.

On the industrial side of the picture, vinyl electrical tapes are now standard items. Oil well distribution pipes some-

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INDEX OF Advertisers

June 1946

Advertiser	Advertising Agency	Page
Aaron Machinery Co.		108
Accurate Molding Corporation	Rothschild Advertising Agency	103
American Flange & Manufacturing Co., Inc.	Freiwald & Colemen Advertising	41
American Molding Powder and Chemical Corp.	Lee-Murrey Advertising Agency	99
American Phenolic Corporation	Burton Browne Advertising	11
Amos Molded Plastics	Sidener and Van Riper, Inc.	20
Armour and Company	Foote, Cone & Belding	84
Arrow Plastics Company	Powerad Company, The	109
Austin Tool & Mfg. Co.		104
Bemberger, A.	Lee-Murrey Advertising Agency	93
Bettelen, L. H.	Gunn-Meers Advertising Agency	104
Boonton Molding Company	A. J. Slomanson Associates, Inc.	8
Brilhart, Arnold, Ltd.	Henri Le Mothe Agency	4th Cover
Cetelin Corporation	Walter J. Gellegher, Advertising	2d Cover
Cee-Bee Mfg. Company, The		90
Celanese Plastics Corporation	Ivey and Ellington Inc.	9
Cello-Nu Products Inc.	Sam Halpern Advertising Agency	101
Cello-Plastic Chemical Co.	H. M. Dittmen Advertising	95
Celluplastic Corporation	M. C. Diedrich	48
Chicago Molded Products Corporation	Almon Brooks Wilder, Inc.	27
Cibe Products Corp.	Cory Snow, Inc.	85
Columbia Protektosite Co., Inc.	United Advertising Agency	35
Continental Can Company, Inc.	Betten, Barton, Durstine & Osborn Inc.	6
Continental-Diemond Fibre Company	Beaumont, Heller & Sperling, Inc.	61
Continental Plastics Corporation	Jim Duffy Company	83
Continental Screw Company	Rossi & Hirshson	75
Cook, Lawrence H., Inc.	George T. Metcalf Co.	77
Cumberland Engineering Co.	Richard Thorndike	86
Detroit Mecold Corporation	Walter J. Gellegher	67
Detroit Stamping Company	Charles Schwein Company	97
Dickten & Mesch Mfg. Co		94
Dow Chemical Company, The	MacManus, John & Adams; Inc.	31
Duall Molding Corp.	Gunn-Meers Advertising Agency	104
Ekstrom, Carlson & Co.	Cummings, Brand & McPherson	108
Electric Auto-Lite Company, The	Ruthreuff & Ryan, Inc.	36
Emeloid Co., Inc., The	United Advertising Agency	17
Emermen Machinery Corp.		94
Engineering Specialties Corporation	Maxon, Inc.	105
Feisenthal, G., & Sons	Lieber Advertising Co.	79
Fischberg, Charles H. & Co., Ltd.		98
Fisher Chemical Company		91
General Electric Co.	Benton & Bowles, Inc.	39
General Industries Company, The	Fuller & Smith & Ross Inc.	13
Gering Products Inc.	M. C. Diedrich	16
Girdler Corporation, The	Roche, Williams & Cleary, Inc.	5
Gits Molding Corporation	Merchendising Advertisers	100
Goodrich, B. F., Chemical Company	Griswold-Eshlemen Co., The	63
Gorski Bros.		112
Great American Color Company		109
Hessall, John, Inc.	Anderson, Davis & Platte, Inc.	87
Hydraulic Press Mfg. Co., The	Jay H. Meish Company, The	3
Industrial Molded Products Co.	Wesley E. Sherer & Associates	14
Karlstad, Andrew C.		108
Kingsley Gold Stamping Machine Co.	Continental Advertising Service	107
Kirk, F. J., Molding Co.	Cory Snow, Inc.	98
Kreiger Color & Chemical Company	Warren P. Fahlman Adv. Co.	105
Kuhn & Jacob Molding & Tool Co.	Eldridge-Northrop, Inc.	89
Kurz-Kasch, Inc.	Kircher, Helton & Collett	19
Le Rose, W. T., & Associates	Aldridge and Preston Advertising	51
Lester—Phoenix, Inc.	Gregory Advertising, Inc.	54
Mees & Waldstein Company	Hutchins & Greves, Inc.	33
Meck Molding Co., Inc.	George Homer Martin	10
Magnetic Plastics Company, The	Gregory Advertising, Inc.	107
Martindell Molding Company	Eldridge-Northrop, Inc.	80
Michigan Molded Plastic, Inc.	Wallace-Lindeman, Inc.	59
Mosinee Paper Mills Company	Klau-Van Pietersom-Dunlap Asso., Inc.	45
National Lock Company	L. W. Remsey Advertising Agency, The	88
National Plastic Products Company, The	Joseph A. Wilner Company, The	104
Nicholl Herd Chrome Service		96
Northern Industrial Chemical Co.	Callaway Associates, The	96
Pennsylvania Coal Products Company	Lee-Murrey Co., Advertising	12
Pleskin Division, Libbey-Owens-Ford Glass Company	Meldrum & Fewsmith Advertising	53
Plastics Service Engineering		106
Plastics Industries Technical Institute	Beaumont and Hohman Incorporated	104
Radio Receptor Company, Inc.	John A. Finneran	43
R E C Mfg. Corporation	Cory Snow, Inc.	102
Schwartz Chemical Company	Gunn-Meers Advertising Agency	15
Siegel, M. B., Associates	Craig E. Dennison Advertising Agency	106
Silicocks-Miller Co., The	Fred H. Ebersold Inc.	91
Stokes, F. J., Machine Company	McLain Organization, Incorporated	64
Tarbonis Co., The	L. G. Melson & Co.	111
Tennessee Eastman Corporation	Kenyon & Eckherdt Inc.	25
Texon Industrial Corp.		106
Union Tool Co.	George T. Metcalf Co.	100
Universal Hydraulic Machinery Company	Gunn-Meers Advertising Agency	108
Universal Plastics Corporation	Ceyton, Inc.	71
Van Dorn Iron Works Co., The	Hubbell Advertising Agency, The	7
Waterbury Companies, Inc.	Manternedh, Inc.	111
Worcester Moulded Plastics Co.	C. Jerry Spaulding, Inc.	Third Cover
Wrigley, Wm., Jr., Company	Ruthreuff & Ryan, Inc.	82

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SITUATIONS WANTED

BUTTONS—Specialist in the manufacture of buttons from casein, urea, phenolic, and melamine plastics; familiar with all the latest streamlined methods of production as well as multicolored, pearlescent and fluorescent effects; seeks responsible position preferably as assistant or consultant to top executive. Must be a high-rated concern offering congenial and pleasant conditions. Reply Box 82, % Plastics, 185 N. Wabash Ave., Chicago 1, Illinois.

DESIRE position either as foreman or chief of I.E. dept. or Chief Eng. in small plant. B.I.E. degree. Credits for M.Ad.E. Now Asst. Mgr. I.E. Dept. Exper. trng. sup. T.S.M. and std. data application for various operations. Please reply to Box 83, % Plastics, 185 N. Wabash Ave., Chicago 1, Illinois.

EXPERIENCED Purchasing Agent offers 25 years' experience with large corporations. Knows material control and scheduling, machine shop and foundry practice, industrial processing. Last two connections with leading firms in plastics and airplane industry. Excellent references. Write Box 84, % Plastics, 185 N. Wabash Ave., Chicago 1, Illinois.

HELP WANTED

WANTED: Chief Engineer to head engineering department covering all plant, product and mold engineering work and reporting direct to management. Must have ability to run department and to cooperate and coordinate in plant producing thermosetting and thermoplastic products with most up-to-date equipment. Mechanical engineering background preferred. Located in Connecticut. Give age, experience and salary requirements. Box 85, % Plastics, 185 N. Wabash Ave., Chicago 1, Illinois.

PLASTIC production superintendent or plant manager required for well established injection molding plant located in Toronto. Permanent connection and good remuneration to man with initiative and broad experience in molding and assembly operations. Knowledge of tools and jigs essential. Please write fully in confidence to Box 86, % Plastics, 185 N. Wabash Ave., Chicago 1, Illinois.

WANTED—Experienced Injection Molding Supervisor. Excellent opportunity for qualified applicant to assume complete supervision of plant in mid-south city. Must be thoroughly familiar with all thermoplastics, molds and machinery. Furnish complete information concerning experience, qualifications and salary expected. Box 91, % Plastics, 185 North Wabash Ave., Chicago 1, Ill.

CHEMICAL Engineer Wanted. Process and research man for company making thermosetting plastic sheets. Man must be capable of assuming direction of laminating department and laboratory. Must be a graduate chemist with at least fifteen years' experience in the laminating field. Must know processes and be ahreast of the latest in resins, processes, etc., applicable to this industry. Write to Box 87, % Plastics, 185 N. Wabash Ave., Chicago 1, Illinois.

COLOR Chemist—Thoroughly experienced in the pigmenting of thermosetting and thermo-plastic resins, conversant with all types of pigments and dyes. Wonderful opportunity, excellent working conditions for right party. Give details in first letter. All replies confidential. Box 88, % Plastics, 185 N. Wabash Ave., Chicago 1, Illinois.

MISCELLANEOUS

WELL known plastic manufacturing co. located in Texas for sale. Plant equipped to handle all plastic material except molding, also machine shop and wood working equipment for various other types of work. Will make very attractive offer if interested. Box 89, % Plastics, 185 N. Wabash Ave., Chicago 1, Illinois.

WANTED: Polystyrene Powder or scrap in any color or amount. Also acetate or Ethyl Cellulose. Please quote price and delivery. Also interested in steady source for Polystyrene. Willing to pay top prices for quick delivery. Box 90, % Plastics, 185 N. Wabash Ave., Chicago 1, Illinois.

INJECTION molding of small and medium plastic items is our specialty. Open capacity at present. Prompt replies to all inquiries. Plastic Products Co., Box 384, Dept. P, Massillon, Ohio.

OPEN Time Injection Molding. Can give immediate delivery on machines up to 9 oz. capacity. Jobs with material furnished by customer preferred. Can start tooling on new jobs immediately. Plastic Molded Products Co., 5205 W. Irving Pk. Road, Chicago 41, Illinois. Palisade 7667.

times have a continuous spiral bandage of cellulose acetate film to protect the pipe against corrosion. The difficulty in producing a perfect continuous seal by solvent action is the only drawback. Vinyl heat-sealing films will offer even more protection with a foolproof sealing method. Improved, stabilized formulations of vinyl butyral film for safety glass interliner assures continued production of large volumes of this material to meet the demand for the automobile industry. In spite of the widespread use of acrylics for bomber noses, their general use for automobile windshields seems unlikely in view of their low abrasion resistance. A possible competitor for glass may develop in the allyl copolymer resin field, but, for the present at least, glass with a plastics film liner is indicated.

Cellophane Used

Cellophane, too, is finding application in the industrial field, where it is used as a mold liner with the allyl copolymer resins to prevent sticking of the heated plastics. The amount used in this field will grow as production increases in the allyl resin field. The silicone resin films are being used in electrical equipment operating at high temperatures for both insulation purposes and to keep out moisture. The non-wetting properties of this film have been widely publicized, so that it should not be long before some enterprising inventor discovers some application, probably in the form of a laminate, whereby these properties can be utilized to advantage.

The future of the continuous film field is bright and the volume of material used is increasing daily. In the future, the designer will be much less limited in the choice of plastics with the desired physical requirements, and he may feel assured that it will not be long before the film manufacturer can meet his demands as to film widths and thicknesses. END

In a later article, Mr. King will discuss the methods of producing films and their significance for applications.—Ed.

Container Fabrication, Part I

(*Continued from page 26*)

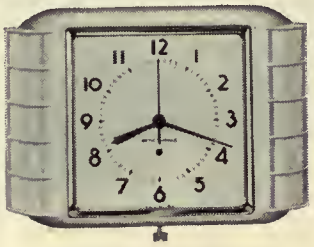
a beaded edge imparts to the container a greater overall rigidity, which could, in many instances, permit a reduction in thickness of the material itself. This problem does not arise with the drawn cylindrical container, since this can be beaded by the groove method. If a device or method is developed for beading the drawn rectangular container, it will be applicable to the folded container as well, so that any type of side-walled container will be able to take its beading as a terminal operation.

Possible Solution

A possible solution to this problem comes to mind in the principle of the rotary can-opener, in which, once the lip of the can has been caught up in the jaws of the device, it is sent through a guide that U-folds it to the inner wall of the can. Of course, the fold is not a round bead and no heat is needed. Both requirements are present in the terminal beading of rectangular containers of rigid sheeting. What is visualized as needed in this case is (1) a grip for holding the edge of the container in the machine as the edge moves; (2) a heating element and beading die of the type used in continuous beading machines; (3) a pinching element that will collapse the bead as it approaches the corner of the container and will pinch it to a flat fold at the corner itself; and (4) a tripping mechanism that will change the direction of travel of the container when a corner is reached. (TO BE CONTINUED)

WATERBURY

Moldings of Merit



This smart, attractive kitchen clock, a product of SETH THOMAS, owes much of its eye appeal to its gleaming plastic case—a Molding of Merit by Waterbury Companies, Inc.

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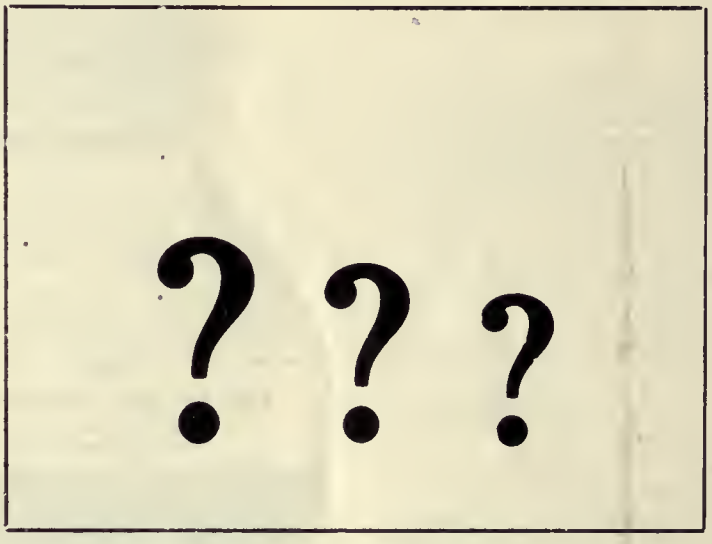

Watch for the picture appearing in this space next month

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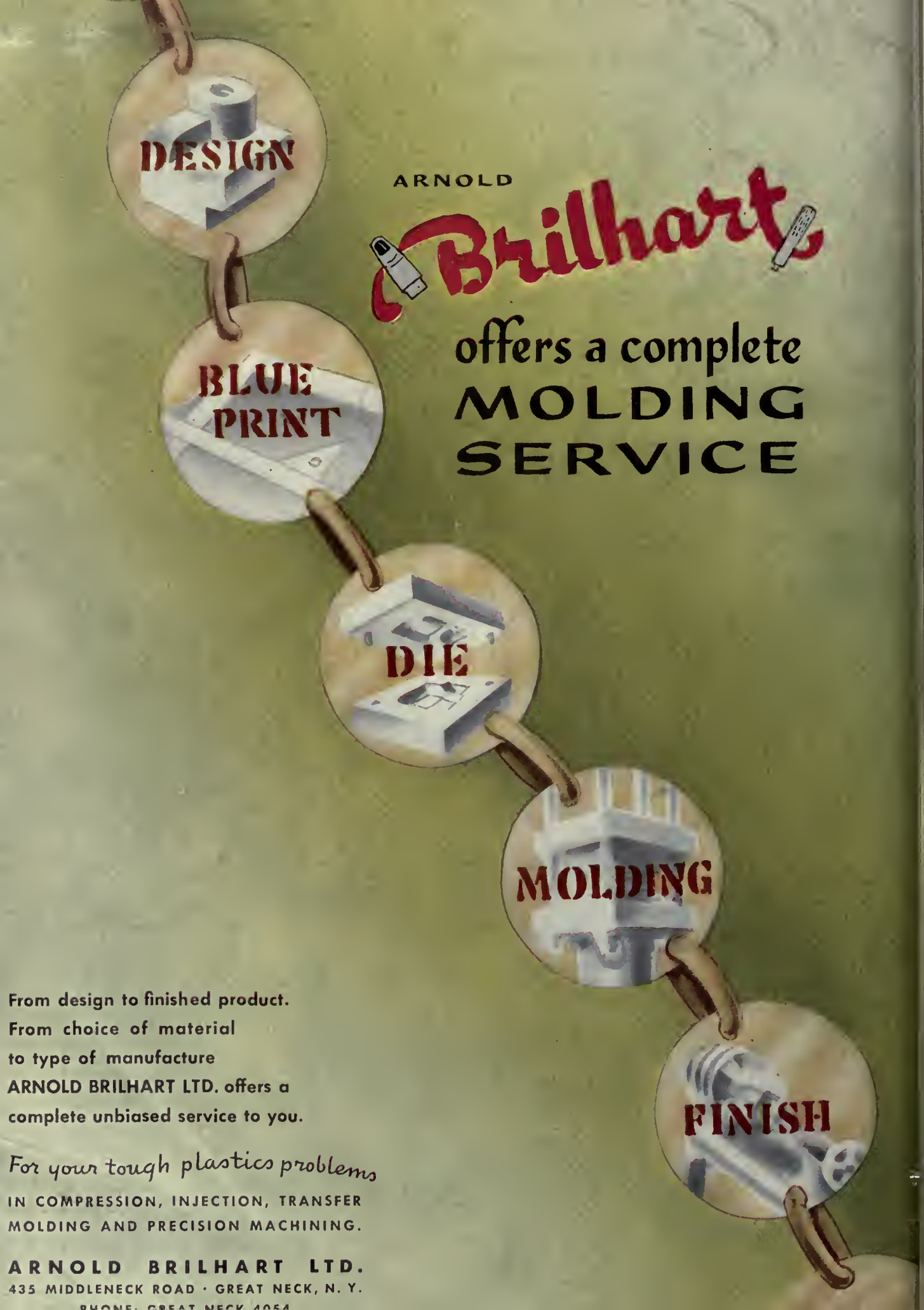

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